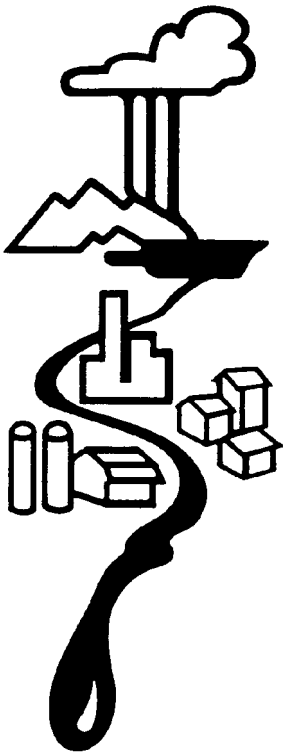
1.0 INTRODUCTION

Mercury is a persistent, bioaccumulative, toxic pollutant. Exposure to mercury can cause numerous harmful effects in plants, birds, mammals and humans. When released into the environment, even small quantities of mercury accumulate in the sediments of water bodies, are ingested by and bioaccumulate in animals and fish, and are passed up the food chain. Mercury deposited in water bodies is easily converted to methyl mercury, a particularly toxic form of mercury, in sediments. Since methyl mercury accumulates in the tissues of fish and animals, it is readily transmitted through the food chain, up to and including humans.

As a result, mercury contamination in the environment is a significant public health and environmental problem. Federal and state governments, as well as the private sector, have taken many steps to reduce releases of mercury to the environment. Recently, New Hampshire participated in a cooperative effort to develop a *Regional Mercury Action Plan* under the auspices of the Conference of New England Governors and Eastern Canadian Premiers (*NEG/ECP, June 1998*). The regional action plan calls for the "virtual elimination of man-made mercury releases" and the recommendations detailed in the plan should result in substantial mercury reductions over the next several years. In New Hampshire, mercury reduction efforts have included eliminating mercury in batteries and product packaging, promoting the recycling of mercury-containing wastes and prohibiting the use of pesticides that contain mercury. Despite these efforts, mercury is still being released and deposited in quantities significant enough to threaten public health and environmental quality. Because mercury concentrations in fish continue to be at levels of concern, New Hampshire and many other states have issued advisory warnings cautioning against too much consumption of freshwater fish (see Section 3.1.1).



Distant upwind sources of mercury are an important factor in the Northeast's mercury deposition problem. Mercury emitted into the air can be transported great distances by prevailing winds. Much of it is then washed out of the air by precipitation and deposited on land and into water bodies. This airborne mercury, combined with sources of mercury within New Hampshire and the Northeast, results in increased mercury levels in fish and wildlife. Sources in the Midwest such as coal-fired power plants are significant contributors to mercury deposition in the Northeast. In recognition of this, the Environmental Protection Agency has recently requested that coal-fired utilities provide additional data on their mercury emissions. This information will be used to better determine the actual contribution of mercury from this source. Other recent federal efforts include several pieces of proposed legislation ranging from reducing mercury in products to requiring sources to do more mercury emissions monitoring.

Based on analyses conducted by the New Hampshire Department of Environmental Services (DES) and others, it is apparent that in-state sources also contribute significantly to the problem of mercury contamination. New Hampshire needs to take a strong leadership role in reducing mercury emissions from in-state sources, in order to achieve reductions in the regional mercury emissions inventory and reduce mercury transport to areas further downwind. Addressing sources within the state will also enhance New Hampshire's ability to seek reductions by sources outside of the state and region.

This report -- ***The New Hampshire Mercury Reduction Strategy*** -- describes and details steps that the State of New Hampshire intends to take in order to reduce mercury pollution in the State. It provides a summary of the public health and other impacts of mercury contamination, lists sources and pathways by which mercury enters the environment, and recommends actions that should be taken to reduce the amount of anthropogenic (man-made) mercury emitted into the environment. ***The actions recommended in this strategy are expected to achieve at least a 50% reduction in mercury releases from New Hampshire sources by 2003.*** The DES, in conjunction with other agencies and organizations, will continue to work toward the virtual elimination of anthropogenic mercury releases by seeking solutions for those mercury sources that do not currently have feasible emission controls or reduction methods available.

CASE STUDY

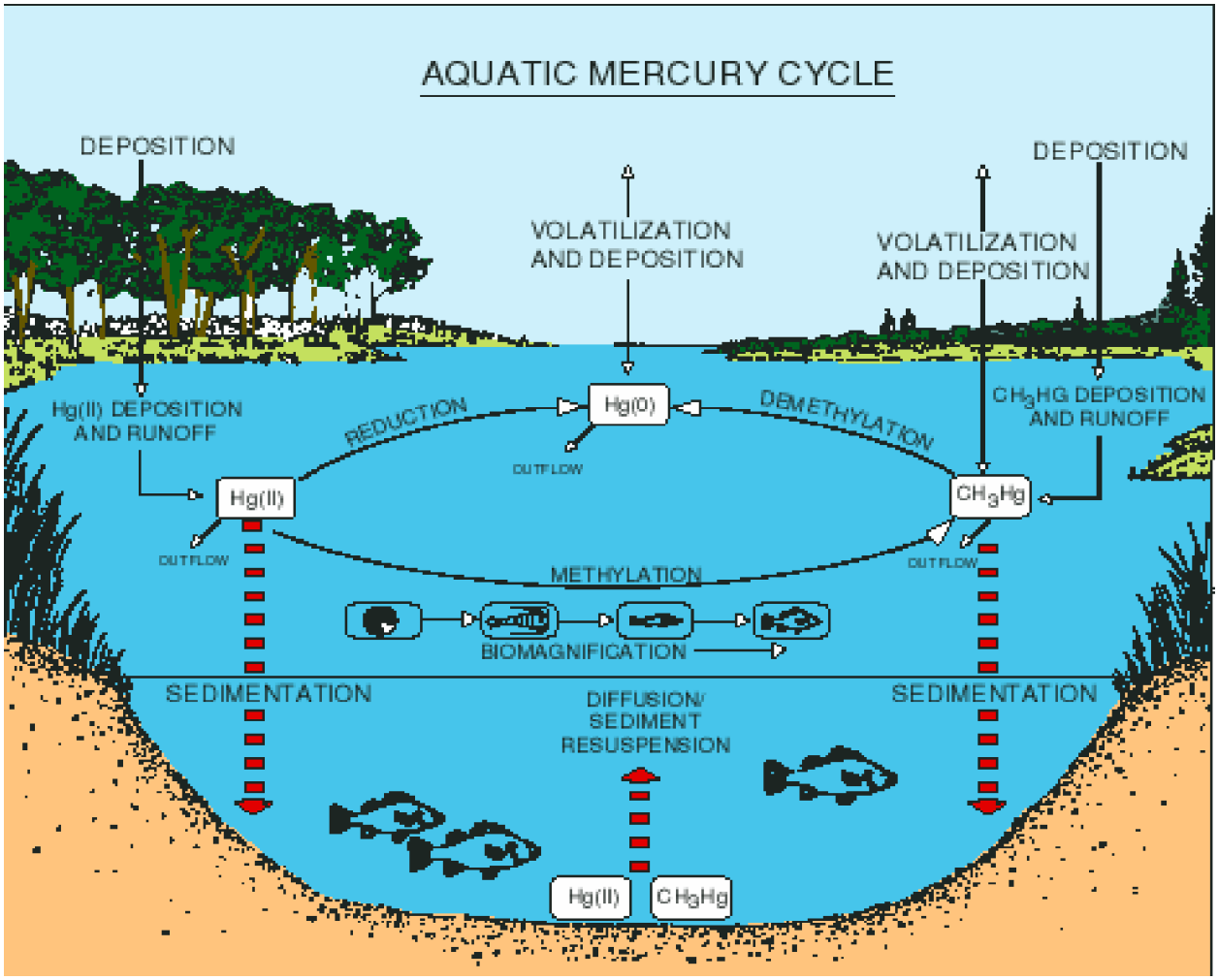
Commercial Pesticides

The New Hampshire Pesticides Control Board has placed all mercury-containing pesticides on the prohibited use list, which means they can not be used in New Hampshire. This action is more restrictive than other state or national initiatives, in which products are being phased out, but product on the shelf can still be used. As of December 31, 1996, mercury-containing pesticides can not be used in New Hampshire.

2.0 ORIGIN AND TRANSPORT OF MERCURY

Mercury is introduced into the environment through three principal processes. The first occurs naturally: mercury is emitted from volcanoes, the weathering of rocks, forest fires, and soils. In the second process, mercury is emitted as a result of human activities such as the burning of fossil fuels and municipal or medical waste. The third route is the re-introduction of mercury into the environment through natural processes such as evaporation of ocean water. **Figure 1** illustrates how mercury cycles through the aquatic environment.

Figure 1



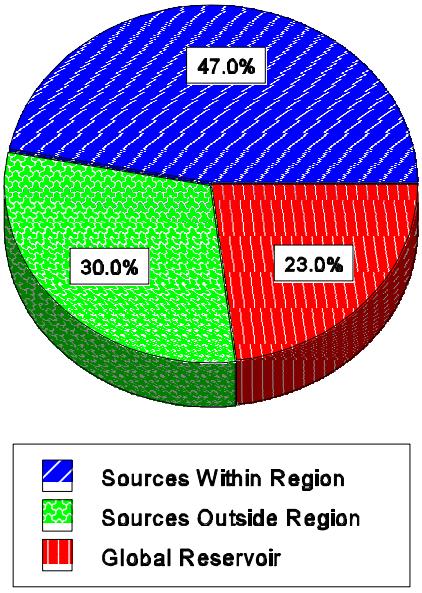
Once it is released into the atmosphere, mercury is deposited on the earth's surface by wet or dry deposition. Wet deposition occurs as a result of rain or snow storms. Dry deposition occurs as a result of wind storms and forest fires. Deposition of both types can occur in as little as 5-14 days after mercury is emitted to the air, or can take approximately one year -- during which time mercury can reside in the atmosphere and be transported far around the globe. The transport and deposition of mercury from anthropogenic sources is dependent upon release height (stack height), exhaust

conditions (temperature, velocity), mercury speciation (elemental or divalent) and form (vapor or particulate), other chemical pollutants emitted along with mercury, meteorological conditions and the chemical make-up of the airmass. Because of these many variables, current methods of evaluating mercury transport are not yet able to accurately link specific mercury sources to mercury concentrations in specific locations.

The U.S. Environmental Protection Agency's (EPA) *Mercury Study Report to Congress, (December 1997*) indicated that anthropogenic mercury emissions comprise 50-75% of all mercury released into the atmosphere in the United States. Mercury in New Hampshire is both emitted from New Hampshire sources and carried here from emission sources in upwind areas.

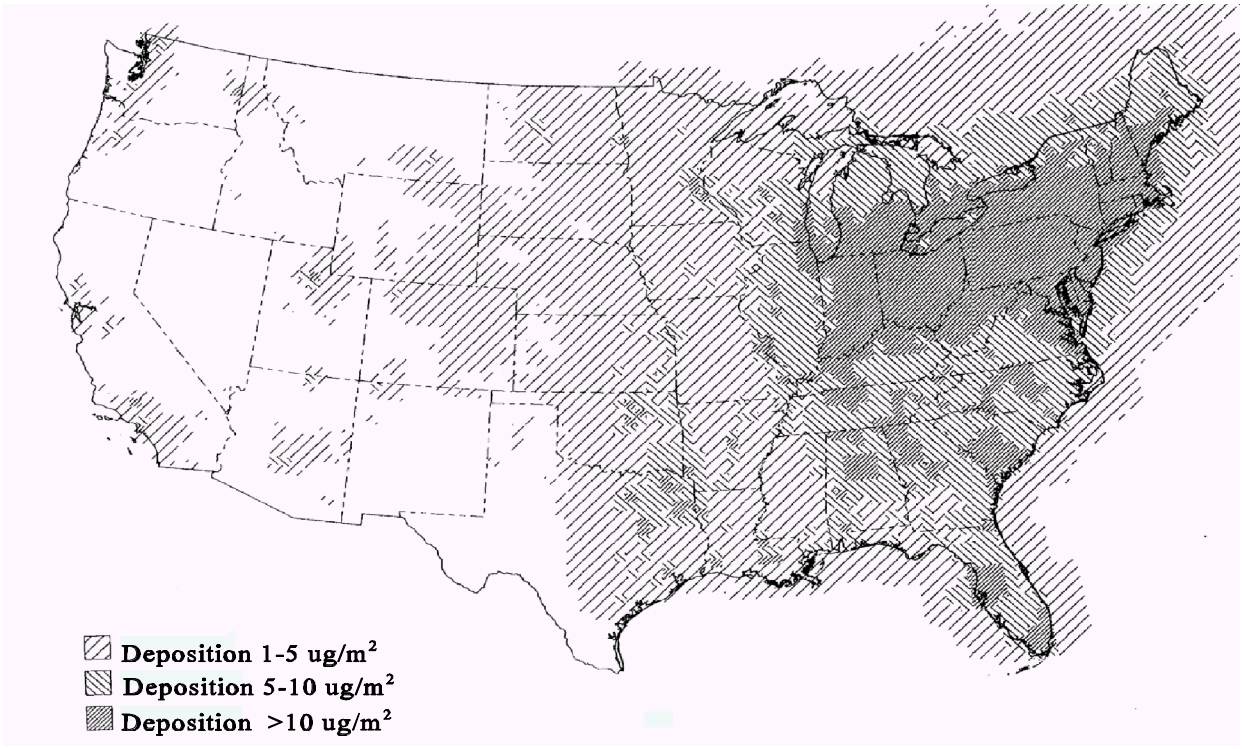
Recent estimates indicate that 47% of the mercury deposited in the Northeast originates from sources within the region, 30% from sources outside of the region, and 23% comes from the global mercury reservoir, which has been created over time from both natural and man-made sources (see **Figure 2**). Emissions upwind of New Hampshire are primarily attributable to coal-fired utilities and municipal and medical waste incinerators in the Northeast and Midwest. Studies show that mercury deposition rates in the Northeast are higher than in other areas of the country due to the combination of local emissions and transport from upwind sources. This is illustrated by **Figure 3** which is drawn from the *Mercury Study Report to Congress* and illustrates the total anthropogenic mercury deposition rates for the continental United States.

Figure 2
1998 Estimated Sources of Mercury Deposited in the Northeast



Source: Northeast States/Eastern Canadian Provinces Report on Mercury, 1998

Figure 3
Anthropogenic Mercury Deposition Rates in the United States



Many of the same sources that emit mercury also emit other harmful pollutants like oxides of sulfur and nitrogen, fine particulate matter, and other toxic compounds. Nitrogen oxides react with volatile organic compounds in the presence of heat and sunlight to produce ground-level ozone or smog. Sulfur dioxide is a major cause of the fine particulate matter that has been estimated to cause 60 deaths in New Hampshire each year (*Natural Resources Defense Council, 1996*). Sulfur and nitrogen oxide compounds released to the atmosphere are also converted to sulfuric and nitric acid, resulting in acid deposition and acid rain. Since these are serious environmental and public health problems in New Hampshire, DES has undertaken a number of initiatives, both voluntary and mandatory, to reduce emissions of all of these pollutants in the State. A summary of New Hampshire's mercury reduction efforts is contained in **Appendix 1**.

High mercury levels in fish sampled from remote lakes and ponds across New Hampshire, which are located far from any combustion sources, indicate that mercury is more than just a regional problem. Numerous scientific studies and computer simulations show that a significant amount of these pollutants originate outside of New Hampshire and are transported here by prevailing winds. Consequently, it is essential to secure reduction of these pollutants from upwind sources. New Hampshire believes that the most effective way to obtain these reductions is to lead by example. As a result, New Hampshire has chosen to take a leadership role by developing this strategy to reduce its own emissions of mercury. Individual states can make significant contributions to correcting the mercury contamination problem by reducing their own emissions and by calling for action on a national and international level.

3.0 IMPACTS ON PUBLIC HEALTH AND THE ENVIRONMENT

3.1 Human Health Effects

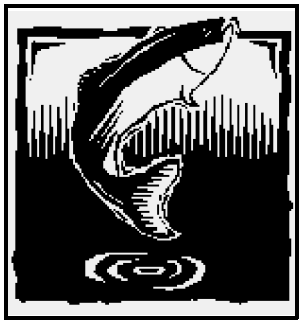
Mercury exposure in humans can lead to a variety of negative health effects including neurotoxicity, kidney toxicity, gastrointestinal toxicity, genetic toxicity, cardiovascular toxicity, dermal toxicity, developmental toxicity and even death. The severity of these effects depends on the route and duration of exposure, the delivered dose, the chemical form of the mercury (e.g., elemental versus methyl mercury), the physical parameters of the environment (e.g., temperature, wind direction, etc.), exposure to other chemicals and stressors, and the age, gender and physical condition of the individuals exposed.

Methyl mercury is transported across the blood-brain barrier and, in pregnant women, across the placenta into the fetus. In young children and fetuses, methyl mercury inhibits the normal development of the nervous system and these effects may occur even at low exposure levels. The extent of the damage frequently is not apparent until later in the developmental process when the child's motor and verbal skills are found to be delayed or abnormal. Developmental effects have been found in children who were exposed in utero, even though their mothers did not experience any symptoms of adult toxicity.

Food, primarily fish, is the most significant source of methyl mercury exposure for the general population. Other potential exposure pathways exist, such as breathing vapors from accidental mercury spills or breathing mercury-containing vapors from incinerators and fossil fuel plants, but these are much less likely to affect the general population. In addition, some mercury exposure to individuals may occur from dental amalgam, but the effects of this are not well documented.

3.1.1 Fish Consumption Advisories

Public health experts, scientists, and environmental experts view mercury contamination as a serious health and environmental issue. Mercury contamination in freshwater fish is widespread and significant enough to warrant fish consumption advisories in New Hampshire and 39 other states (see **Figure 4**). Although some states do not currently have mercury advisories, this may be attributable more to lack of monitoring data than low mercury concentrations (*Northeast States/Eastern Canadian Provinces Mercury Study, 1998*).

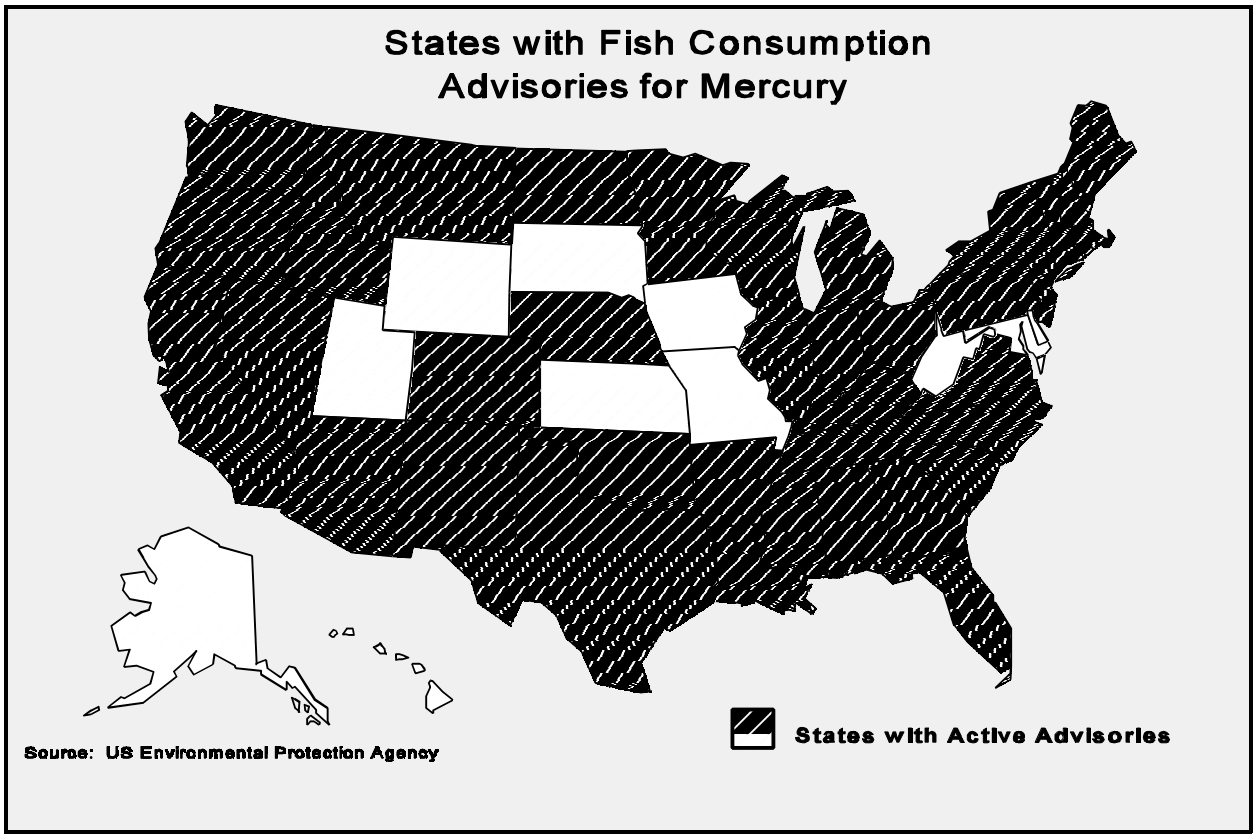


New Hampshire's statewide fish consumption advisory, issued by the New Hampshire Department of Health and Human Services, applies to all freshwater fish species collected from all inland waters. New Hampshire's advisory recommends that women of childbearing age and young children limit their consumption of freshwater fish to no more than one meal per month. All other people are encouraged to limit their freshwater fish consumption to no more than four meals per month. The advisory further encourages the public to eat smaller, younger fish, which contain less mercury. The National Marine Fisheries Service and the US Food and Drug Administration (USFDA)

evaluate and regulate the content of mercury in marine fisheries. The USFDA has established an action level of 1 part per million (ppm) for saltwater and freshwater species. Several studies of marine fisheries have demonstrated that mercury concentrations do not appear to be increasing in those species sampled, however some species such as tuna and swordfish, do contain mercury levels of concern, and pregnant women and young children are urged to consume these species in moderation.

Based on over 400 samples of 20 fish species collected from inland waters throughout the State, mercury levels in New Hampshire freshwater fish range from 0.02 to 2.26 parts per million (ppm). Eight percent of the fish sampled had mercury concentrations exceeding the action level established by the USFDA. The amount of mercury present in fish is related to a number of variables, including water and watershed characteristics, fish species, and fish size (or age). Mercury concentrations tend to be higher in larger fish and in fish from tea-colored and relatively acidic waters. Concentrations exceeding 1 ppm were found in four species of fish: largemouth bass, small mouth bass, pickerel, and yellow perch.

Figure 4



3.2 Environmental Effects

Methyl mercury exposure also adversely affects plants, fish, mammals and birds. Effects on plants include decreased chlorophyll production, inhibited growth, root and leaf damage, accelerated aging, and death. Reproductive problems are the primary concern for birds (e.g. loons, eagles, herons and kingfishers) suffering from mercury poisoning. These effects can occur with dietary concentrations of mercury that are well below those which cause overt toxicity. Recent data collected by the Loon Preservation Committee (LPC) in Moultonborough, New Hampshire showed that among 95 abandoned loon eggs, 66% had mercury levels at or above the "lowest observed effects" level of 0.5 ppm, or at levels that may cause reproductive impairment of > 1.0 ppm. Furthermore, 4.2% had mercury levels believed to be sufficiently high to prevent hatching (*Loon Preservation Committee, 1998*). Additional mercury effects in birds include liver damage, kidney damage, and neurobehavioral effects. These same effects may be found in other wildlife that prey on mercury contaminated fish such as snapping turtles, otters and mink (*USEPA, 1997*).

Effects on wildlife are greatly determined by such factors as feeding habits and placement in the food chain. Since carnivores accumulate more mercury than omnivores, those species at the top of the aquatic food chain are at greater risk for methyl mercury exposure. Several recent studies on bird species in the Northeast have documented elevated mercury levels in bald eagles, common loons and osprey. In the Atlantic Region of Canada, mean mercury concentrations close to 5 ppm have been reported in the blood of some adult loons. Similarly, elevated levels of mercury have been found in fish-eating mammals such as mink and otter *(Northeast States/Eastern Canadian Provinces Mercury Study, 1998*).

Data collected by the Audubon Society of New Hampshire (ASNH) in 1997 indicates that fish-consuming wildlife in the state -- such as loons, eagles and otters -- are also at risk. For example, mercury levels in the blood of New Hampshire loons averaged 1.85 ppm in females and 3.45 ppm in males in 1997 *(ASNH, 1997*). Of significant concern, individual loons caught again in 1998 show additional accumulation of 8-12% over 1997 in blood mercury levels (Evers, et. al., 1998). Continued study is clearly warranted in order to further assess the adverse effects of methyl mercury exposure on plants and wildlife.

4.0 REDUCING MERCURY IN NEW HAMPSHIRE

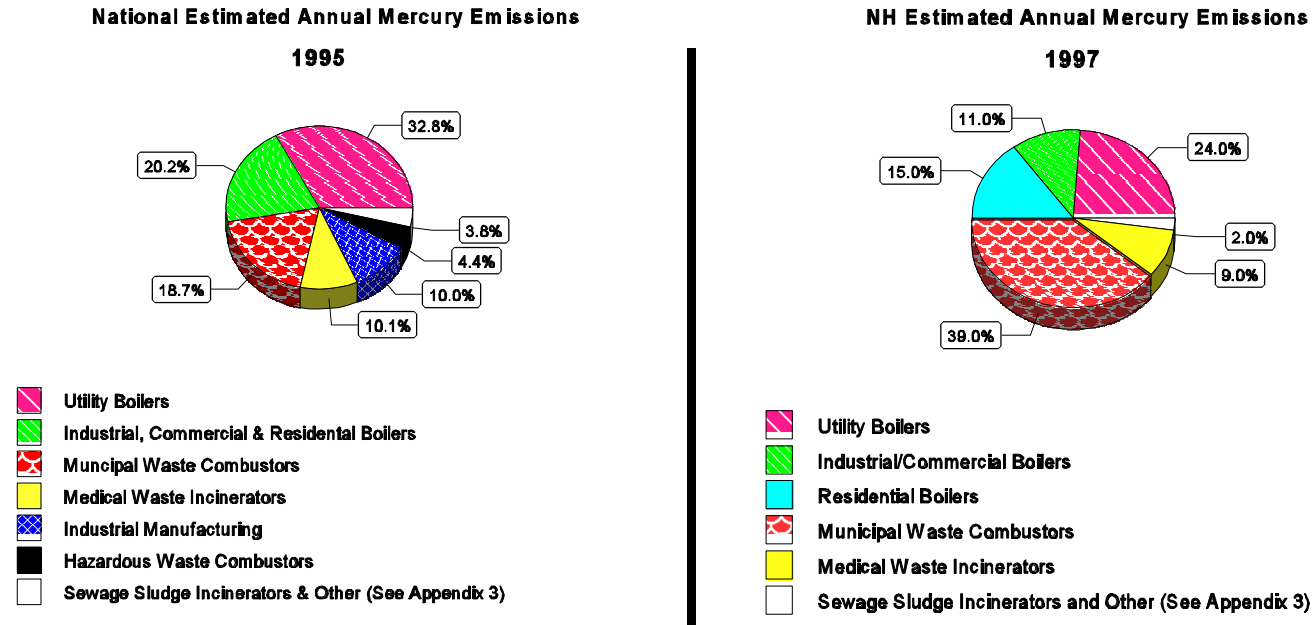
4.1 Introduction

Approximately 98% of the mercury released into the air in New Hampshire comes from the combustion of fossil fuels, such as coal and oil, and the incineration of waste (municipal solid waste and medical waste); the other 2% comes from sewage sludge incineration and other emission sources such as fluorescent lamp breakage and mobile sources. The burning of fossil fuels for the production of electricity and steam releases mercury during the combustion process. Facilities that burn coal have particularly high emissions of mercury. Facilities and devices that burn fossil fuels are not currently regulated for mercury emissions. In waste incineration, many discarded items (e.g., fluorescent lamps, electronic switches and components, and some thermometers and older batteries) contain mercury. When these items are burned, mercury is released from the incinerator stack.

In addition, non-emission sources such as the land application of sewage sludge, and medical and dental wastes also release mercury to the environment, but how much is not clear. Because mercury is highly persistent once released into the environment, all sources are cause for concern.

The major categories of sources that contribute mercury to the environment (see **Figure 5**), and strategies for reducing those contributions, are discussed in detail in the following sections. **Appendix 2** provides a comprehensive list of known New Hampshire mercury emissions sources, and **Appendix 3** contains a detailed comparison of state and national sources of mercury, by category.

Figure 5



Source: USEPA Mercury Study Report to Congress

Source: DES Air Emissions Data

4.2 Municipal Waste Combustors

4.2.1 Introduction

Municipal waste combustors (MWCs) comprise 39% of New Hampshire's mercury emissions. Two sizeable municipal combustors (located in Concord and Claremont), represent 35% of these emissions, while ten other small combustors represent the remaining 4%. EPA regulations for large combustors (combustion units that burn more than 250 tons per day) became effective on August 15, 1997. Due to its size, the only New Hampshire facility subject to these regulations is the Concord facility. DES has already completed rulemaking to implement these federal requirements and will submit an implementation plan to EPA by the end of 1998. The Concord facility will have one year from the date that EPA approves this plan to come into compliance with the regulations. Small MWCs (combustion units that burn less than 250 tons per day) will also be subject to new federal regulations for mercury emissions, but regulations for these facilities will probably not be drafted by EPA before the end of 1998 and are expected to affect only three New Hampshire facilities (Claremont, Pelham and Lincoln-Woodstock).

4.2.2 Large Municipal Waste Combustors

In New Hampshire, the two largest municipal waste combustors (the Wheelabrator facilities in Concord and Claremont) account for 90% of the mercury emissions from waste combustors and 35% of all mercury emissions in the State. It is important to note that these mercury emissions estimates are based on EPA's standard emission factors and may not accurately reflect the actual emissions from the Concord and Claremont facilities. Stack testing is the most reliable method for determining actual mercury emission rates from these sources. Single stack tests were performed at the Claremont facility in June 1993 and at the Concord facility in April 1995. In order to obtain more accurate and up-to-date emissions estimates, DES required stack tests to be performed at the Concord and Claremont facilities in the Spring of 1998. The 1998 stack test performed at the Concord facility showed a mercury emission rate of 0.0533 mg/dscm for Unit #1 and 0.152 mg/dscm for Unit #2. The control efficiency for Unit #1 was determined to be 81% (Unit #2 was not evaluated for control efficiency). The recent stack test performed at the Claremont facility revealed a mercury emission rate of 0.102 mg/dscm for Unit #1, and 0.214 mg/dscm for Unit #2. The control efficiency for Unit #2 was determined to be 31% (Unit #1 was not evaluated for control efficiency).

Currently, one state regulation and one federal regulation apply to mercury air emissions from large municipal waste combustors in New Hampshire. The state Air Toxics Control Program requires all stationary sources of mercury emissions (including MWCs) not to exceed a specified health-based ambient air limit (AAL). Both the Concord and Claremont facilities are in compliance with this regulation. The federal regulation will only apply to the Concord facility (as described above, this regulation only applies to combustion units that burn more than 250 tons per day). The new federal regulation will require the Concord

facility not to exceed a mercury emission rate of 0.080 milligrams (mg) per dry standard cubic meter (dscm) or to achieve an 85% control efficiency.

The *NEG/ECP Regional Mercury Action Plan* calls for regional adoption of a 0.028 mg/dscm emission limit for municipal waste combustors that have the capacity to burn more than 250 tons of municipal waste per day (i.e., the Concord facility). The *Regional Action Plan* also recommends evaluating the feasibility of adopting the same limit for smaller combustors with less than 250 ton per day capacity. Consistent with the *NEG/ECP Regional Mercury Action Plan*, DES plans to pursue the adoption of the 0.028 mg/dscm standard for the State's two largest combustors, the Concord and the Claremont facilities. Similarly, the states of Connecticut, Massachusetts, and Maine have introduced legislation to adopt the 0.028 mg/dscm limit. In addition, the State of Connecticut recently passed legislation to establish generation performance standards for mercury emissions from utilities (see Section 4.5).

There are no MWCs located in the States of Vermont and Rhode Island. However, Vermont recently passed legislation that requires any incinerator receiving solid waste from Vermont to use the best required technology consistent with federal law. Vermont entities will not be able to enter into new contracts or renew existing contracts for the incineration of solid waste, unless the facility is in compliance with all applicable federal regulations. This requirement would affect the Wheelabrator Claremont Facility since it currently receives solid waste from Vermont municipalities. The Vermont legislation also contains labeling requirements for mercury-containing consumer products.

The State of Maine has existing legislation that limits mercury emissions from any single source to one hundred pounds by the year 2000 and fifty pounds by the year 2004. Further, in order to keep mercury out of MWCs, Maine's legislation also directs its Department of Environmental Protection to draft additional legislation for the 1999 session that includes: 1) the establishment of a collection system through which mercury-containing products sold or offered for sale in the State can be returned for recycling to the manufacturer of the products, 2) the labeling of retail products that contain mercury, and 3) the imposition of a fee on the sale of mercury-added products.

Outside New England, the states of New Jersey and Florida have already adopted mercury emission regulations that are more stringent than even the new federal limit. New Jersey adopted rules controlling mercury emissions from MWCs in October 1994. Its rules require any facility capable of burning 9.6 tons per day or more of municipal solid waste to install and operate a mercury emissions control apparatus designed to reduce, at a minimum, 80% of mercury emissions by December 31, 1995. The emissions control equipment must be capable of reducing the concentration of mercury in the flue gas from 0.14 mg/dscm to 0.028 mg/dscm. The state of Florida adopted rules in October 1993 that limited mercury emissions to 0.070 mg/dscm for MWCs capable of burning 40 tons per day or more of municipal solid waste. Florida will be reviewing this regulation in September 1998 and is expected to lower it to 0.028 mg/dscm.

The type of mercury emission control equipment being used by the MWCs in both New Jersey and Florida is flue gas injection of activated carbon followed by a baghouse or electrostatic precipitator. EPA estimates the cost of installing an activated carbon system to be $500,000 - $1,000,000. Stack test data from both states has shown actual post-control mercury emission rates to be well below the 0.028 mg/dscm limit (e.g., three MWCs located in New Jersey, equipped with a baghouse and carbon injection system, achieved an average mercury emission rate of 0.0096 mg/dscm). By requiring the Concord and Claremont MWCs to install these controls, New Hampshire could reasonably expect a 95% reduction in mercury emissions from each facility. Using current emission inventory data, this would equate to a 33% reduction in statewide mercury emissions. **Appendix 4** summarizes a preliminary cost analysis conducted by DES of the potential cost impact to the New Hampshire communities of installing these controls at the Concord and Claremont facilities. State financial assistance to the affected communities is also being explored.

Industry representatives have expressed a concern with achieving the 0.028 mg/dscm emission limit on a consistent basis. However, based on data received from both the states of New Jersey and Florida, regarding MWCs equipped with a carbon injection system and a baghouse, DES is confident this limit can be achieved. Industry representatives are also concerned with the ability to accurately measure mercury emissions below 0.028 mg/dscm limit. DES has been assured by EPA that Method 29, which is the EPA approved stack test method used to measure mercury emissions, can measure mercury emission rates well below 0.028 mg/dscm. The detection limit for Method 29 is 0.00056 mg/dscm. The ability to test for mercury below the 0.028 mg/dscm limit has also been proven over the past several years by actual stack tests conducted in New Jersey and Florida on MWCs.

4.2.3 Small Municipal Waste Combustors

Ten small municipal waste combustors currently owned and operated by municipalities also contribute to mercury emissions in New Hampshire. Current estimates indicate that these sources contribute approximately 4% of the total mercury emissions in the State. Imposing a mercury emission limit of 0.028 mg/dscm would substantially reduce mercury emissions from these sources. However, because the volumes of waste processed by these facilities is so small, the cost-effectiveness of installing such sophisticated control equipment is questionable.

Currently, one state regulation applies to small municipal waste combustors. The state Air Toxics Control Program requires all stationary sources of mercury emissions (including small MWCs) not to exceed a specified health-based ambient air limit. Two representative combustors (located in Litchfield and Wilton) were computer modeled to determine their mercury emissions impact and compared to the acceptable mercury ambient air limit. Both combustors were found to be in compliance with the state regulation.

The *NEG/ECP Regional Mercury Action Plan* calls for states and provinces in the region to evaluate the feasibility of adopting a 0.028 mg/dscm limit for combustors under 250 tons per day, on a case-by-case basis. As noted above, achieving this standard by requiring emissions controls on very small combustors is probably not cost-effective. Removal of

mercury-containing sources from the solid waste stream prior to incineration should provide a more cost-effective means of reducing mercury from these sources. (See the discussion of Household/Municipal Solid Waste in Section 4.3) Whether individual municipalities choose to reduce mercury by installing control technology, diverting mercury-containing wastes prior to incineration or closing their incinerators, many will require financial assistance. Low interest loans and other forms of financial assistance should be explored for funding these activities as well.

4.2.4 Recommended Actions[1] Regarding Municipal Waste Combustors

R-1. Reduce mercury emissions from Municipal Waste Combustors (MWCs) by:

(a) Drafting legislation to require a mercury emission limit of 0.028 mg/dscm or lower for the State's two largest MWCs by January 1, 2002; and

(b) Evaluating, by September 30, 1999, the overall technical and economic feasibility of closing small MWCs over time or requiring small MWC's to meet a limit of 0.028 mg/dscm or lower.

R-2. Investigate and draft legislation, if appropriate, by November 1, 1999, to provide financial assistance to New Hampshire municipalities in implementing mercury reduction controls and programs.

R-3. Require annual emissions monitoring and stack testing in order to more accurately monitor actual mercury emissions from the State's two largest MWCs beginning in 1998.

R-4. Establish an external stakeholder workgroup (MWC Workgroup) by October 31, 1998 to, among other tasks, evaluate the need for periodic emissions testing at smaller MWCs. The workgroup should consist of representatives from DES, New Hampshire Department of Health and Human Services (DHHS), Business and Industry Association of New Hampshire (BIA), industry, municipalities, environmental groups and other interested parties.

[1] **Unless otherwise noted, the recommended actions indicated in this strategy are to be undertaken by DES.**

R-5. Encourage reductions in the amount of mercury-containing products entering the municipal waste stream through an Integrated Waste Management Strategy developed by the MWC Workgroup by:

(a) Continuing to work with the MWC operators, through the solid waste operator training program, to identify and remove mercury-containing wastes prior to incineration and ensure that those products are safely recycled (ongoing);

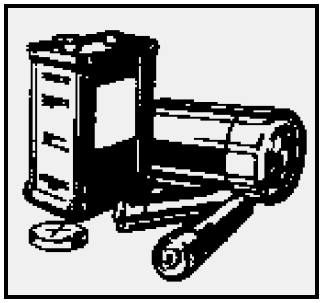
(b) Working with construction/demolition, recycling and other contractors and the MWC Workgroup to remove mercury-containing products such as thermostats and fluorescent tubes from construction and demolition debris and promote their safe recycling, by June 30, 1999; and

(c) Drafting legislation by November 1, 1999 (with an effective date of July 1, 2003) to prohibit the disposal of mercury-containing products and equipment in municipal waste combustors and medical waste incinerators. This legislation will serve as a backstop to ensure pollution prevention objectives are achieved.

4.3 Household/Municipal Solid Waste

4.3.1 Introduction

Mercury from municipal solid waste (MSW) is introduced into the environment primarily as emissions from Municipal Waste Combustors when solid waste is burned. The most common sources of mercury in municipal solid waste are older batteries and button batteries, fluorescent lamps, paint residue, some thermometers, thermostats and other products contributed by homeowners and businesses. Estimates made in the late 1980's of mercury contributions by waste type suggested that batteries and fluorescent lamps account for 85% of the mercury in MSW (72% from batteries and 13% from lamps). However, these estimates did not reflect recent state, federal, and manufacturer initiatives to eliminate mercury in nearly all types of batteries. By 1995, batteries were estimated to account for only 35% of the mercury in municipal solid waste. As the use of older batteries (those that still contain mercury) comes to an end, the amount of mercury contributed by batteries will fall drastically (EPA estimates zero contribution by the year 2000), and the relative contribution of other mercury-containing wastes will increase.



MSW in landfills may also be a source of mercury, but there are few documented cases of mercury contamination (e.g., of groundwater) from landfills. One EPA-funded study

suggested that leachate from municipal landfills does not contain mercury levels above the Toxicity Characteristic Leaching Procedure (TCLP), the test used to determine whether a waste contains hazardous amounts of heavy metals (like mercury) and organic chemicals (*Research Triangle Institute, 1993*). Much uncertainty remains about landfills as a source of mercury in groundwater or surface water, although there is concern that the disposal of mercury-containing lamps in landfills is an important source of air emissions. This is because most, if not all, fluorescent lamps destined for landfill disposal break, either during transport or through compaction at the landfill site, and release some of their mercury into the atmosphere.

The most effective long-term approach for reducing mercury in the solid waste stream is eliminating the presence of mercury in consumer products. Since most consumer products are sold nationally in interstate commerce, Congressional action is necessary to comprehensively address toxicity in the waste stream. A national approach to reducing the toxicity of consumer products would be less expensive and more effective than state-by-state approach. In the absence of such a national approach, however, the NEG/ECP Regional Mercury Action Plan will seek mercury reductions in consumer products. In addition, the states of Vermont and Maine have recently passed legislation requiring, among other things, the labeling of mercury-containing products and the development of manufacturer "take back" programs to ensure the proper management of those products. While DES supports this approach to minimizing the introduction of mercury into the environment, we strongly recommend the development of legislation to prohibit the non-essential use of mercury in consumer and commercial products.

Discussions on specific mercury-containing products and reducing their contribution to the solid waste stream are presented in the following sections.

CASE STUDY
Toxics in Packaging

New Hampshire has been a leader in the effort to reduce the mercury content of packaging which enters the solid waste stream. In 1988, the Coalition of Northeast Governors established a Source Reduction Task Force whose goal was to implement strategies leading to reductions in the heavy metals content of consumer product packaging. New Hampshire was instrumental in helping the Task Force develop a model "Toxics in Packaging" legislation. On April 19, 1990, New Hampshire became one of the first states nationwide to adopt a **Reduction of Toxics in Packaging** law (RSA 149-M:25-32), which limits mercury, lead, cadmium and hexavalent chromium in packaging. Although developed as a northeastern states initiative, 18 states across the country had adopted the law by 1998. Due to this legislation, many companies, including Digital, Eastman Kodak, IBM and Gillette have certified their packaging to meet the requirements of Toxics in Packaging legislation.

4.3.2 Batteries

In 1992, New Hampshire enacted innovative legislation aimed at reducing the mercury content in batteries. New Hampshire RSA 149-M:28 *Restrictions on Battery Sales and*

Disposal, restricted the sale of, and set mercury content limits for, all forms of batteries sold in New Hampshire. New Hampshire was one of the first states to enact such a law. Its passage was made possible by support from a broad range of stakeholders, including battery manufacturers. The law also required that batteries be easy to remove from products (to allow for recycling or proper disposal) and required clear labeling to warn consumers that the battery must be recycled or disposed of properly. Due in part to this ground-breaking legislation, many products including *Apple* computers, *Teledyne* Water Piks and *Black & Decker* rechargeable tools were redesigned to allow for easy battery removal and to include appropriate consumer labeling.

On May 13, 1996, all state and local laws governing battery labeling and disposal were preempted by the federal Mercury-Containing and Rechargeable Battery Management Act. In addition to strict labeling requirements, this law mandates that the handling of spent batteries be managed under the federal "Universal Waste Rule" (UW Rule) codified in EPA Regulation 40 CFR 273, even if a State has not adopted the UW Rule. The UW Rule encourages the recycling of mercury-containing and nickel-cadmium (Ni-Cd) batteries by streamlining handling requirements and by removing the permit application requirements for collectors and intermediate handlers. By the end of 1998, New Hampshire will propose the UW Rule for other types of waste as well, including mercury-containing lamps. DES is coordinating its drafting of the UW Rule with other states through participation in the Northeast Waste Management Officials Association's (NEWMOA) Universal Waste Workgroup.

While new batteries should not create mercury problems in MSW, older batteries will continue to be a presence, albeit a declining one. Along with older batteries, mercuric oxide "button" batteries (which contain 30% to 40% mercury by weight) are also a source of mercury in MSW. Although these batteries comprise only a minute fraction of the waste stream, they are a potent source of mercury and should be recycled. In addition, mercury may be present in batteries that were manufactured outside of the United States and imported into this country, although the extent of this problem is not well known.

4.3.3 Mercury-Containing Lamps

Mercury-containing lamps (fluorescents are the most common) are an important contributor of mercury emissions in municipal solid waste. These lamps are widely used because they are long-lasting and energy efficient. Although some lamp manufacturers have recently reduced the mercury content of their products, mercury is still required for the lamp to function, and significant amounts remain. Fluorescent lamps are expected to soon surpass batteries as the principal source of mercury in municipal solid waste.

Source reduction has been effective in eliminating mercury in batteries, but mercury is still essential for the functioning of a fluorescent lamp. The best effort by manufacturers (e.g., the Phillips ALTO and GE Ecolux models) has been to reduce the mercury level to less than 10 milligrams per lamp. Performing the Toxicity Characteristic Leaching Procedure (TCLP) on ALTO and GE Ecolux lamps, laboratories have consistently found

results below hazardous levels for leachable mercury of 0.2 mg/l. The TCLP is designed to measure the potential of hazardous constituents to leach into groundwater from a landfill. Although these low mercury lamps contain levels below TCLP, and would therefore not be regulated as hazardous waste in New Hampshire, they can still contribute mercury to the environment if not stored or transported in a manner that prevents breakage. When a lamp breaks, 6.8% of its mercury escapes into the dumpster, garbage truck or landfill. If mercury-containing lamps are incinerated without mercury controls, 90% of their mercury is released to the environment as air emissions, with the remaining 10% found in the fly ash and bottom ash (*EPA, June 1997*). Thus, every reasonable effort should be made to ensure that spent fluorescent lamps are recycled rather than disposed of as municipal solid waste.

Mercury reduction in lamps may actually reduce recycling rates by businesses and industry, because disposal of lamps that test below TCLP is allowed under current solid waste regulations. Lamps will continue to be a source of mercury released to the environment unless laws and regulations requiring recycling or prohibiting disposal are enacted, or until mercury-free lamps become available at a reasonable price.

New Hampshire has actively promoted environmentally sound recycling of mercury-containing lamps. In March 1994, DES established a policy that allows spent lamps, if kept intact and destined for recycling, to be exempt from the New Hampshire Hazardous Waste Rules. This policy encourages the recycling of lamps and the development of a lamp recycling infrastructure by eliminating the associated expenses of handling and disposing of mercury-containing lamps as a hazardous waste. The policy will be replaced by the NH Universal Waste Rule once it is adopted by the Department. The Universal Waste Rule will streamline requirements for the handling of spent mercury-containing lamps and encourage the environmentally sound management of spent lamps.

CASE STUDY
Compaq Computer Corporations'
Compaq Services De-Manufacturing Plant

At Compaq Services (formerly Digital Equipment Corporation) Contoocook, NH de-manufacturing plant, electronic equipment is disassembled and recycled. The facility serves 100 customers and handles approximately 25 million pounds of discarded electronic equipment annually. Not only does Compaq take back its own equipment, it accepts equipment, including copy machines, pagers, and computers, from all manufacturers. Less than one tenth on one percent of the material processed at the plant ends up in landfills. Much of the material is recycled, including plastics, ferrous and non-ferrous metals and glass, while many products are refurbished and sold to used equipment brokers. Materials such as gold, silver and platinum are extracted and sold for re-use. In addition to promoting disassembly and reuse of existing equipment, Compaq also advocates the design of products that are easier to disassemble and changing to manufacturing processes that use fewer and less toxic constituents. Compaqs' take-back program is an excellent example of corporate product stewardship throughout its entire life cycle. Similar programs could and should be undertaken for mercury-containing products.

Even with the streamlined requirements of the Universal Waste Rule, the collection and recycling of mercury-containing lamps by municipalities may not increase substantially due to limited municipal staff and financial resources. Households (unlike businesses, schools, institutions and government agencies) are not required to dispose of mercury-containing lamps as a hazardous waste. Lamps from households are only regulated under the hazardous waste rules if they are segregated from the rest of the MSW and collected. Although DES encourages municipalities to segregate, collect and recycle mercury-containing lamps, there is no regulatory mandate that they do so. Because commercial and industrial entities have to pay high hazardous waste disposal fees, there is an economic incentive for them to recycle mercury-containing lamps. This economic incentive does not exist for municipalities. Funding municipal collection of lamps for the purposes of recycling, similar to the DES program for collecting used oil, could significantly enhance the recycling rate. The cost to a community (with an existing transfer station) to set up such a program should be under $100, provided the municipality uses an existing building for storage. This figure does not include the cost of actually recycling the lamps, which is estimated to be approximately $31 per drum (one drum holds 85 lamps), with a $100 pick-up fee. Recycling costs would vary depending on the number of lamps actually recycled by a community.

The State of New Hampshire has an existing contract to recycle fluorescent lamps -- the first of its kind in New England. Municipalities are eligible and encouraged to recycle lamps under this contract, providing them with an opportunity to dispose of spent fluorescent lamps safely. Several New Hampshire communities have taken advantage of this opportunity and at least a dozen more have expressed interest in doing so. **Appendix 5** provides a detailed cost estimate for setting up a municipal lamp recycling program and provides information on the State lamp recycling contract.

4.3.4 Other Contributors

Items such as paint residues, thermostats, thermometers, electric switches (automobiles, appliances), electronic equipment and other miscellaneous products also contribute to mercury in municipal solid waste. In particular, thermostats, thermometers, and switches are estimated to contribute almost as much mercury as fluorescent lamps to the waste stream. Every effort should be made to divert mercury-containing components from the waste stream in order to prevent improper disposal or incineration. For example, the Thermostat Recycling Corporation (TRC) has instituted a national program to recycle mercury-containing thermostats and New Hampshire should make every effort to participate in this program, and others like it. DES should also work to encourage manufacturers to phase-out the use of mercury-containing switches in automobiles and large appliances. In addition, since trees take up mercury during growth, woodburning is suspected of emitting minute amounts of mercury into the environment as well.

4.3.5 Recommended Actions Regarding Household/Municipal Solid Waste

R-6. Continue efforts with municipalities and others to remove mercury-containing batteries from the waste stream and ensure safe recycling consistent with the Integrated Waste Management Strategy detailed in R-5 (ongoing).

R-7. By December 31, 2000, consistent with the Integrated Waste Management Strategy, encourage lamp manufacturers and vendors to reduce the mercury which enters the environment from their products by:

(a) Providing recognition for products with lower mercury content;

(b) Helping them establish "take back" programs to ensure safe recycling; and

(c) Providing information to consumers, through product labeling and other means, regarding mercury hazards and safe recycling of mercury-containing lamps.

R-8. Consistent with the Integrated Waste Management Strategy, encourage municipalities to implement lamp collection and recycling programs (similar to current municipal used oil collection programs or household hazardous waste collection days) by December 31, 2000 by:

(a) Providing technical assistance to municipalities in establishing such programs; and

(b) Providing financial assistance (e.g., through loans, grants or from product surcharges) to municipalities to assist in establishing such programs.

R-9. Beginning June 30, 1999, initiate a public outreach campaign, including mercury-oriented public service announcements to encourage greater citizen awareness of mercury hazards, alternatives to mercury-containing products and the need to safely recycle mercury-containing wastes.

R-10. Beginning June 30, 1999, conduct specific outreach to schools, institutions and government agencies on methods to eliminate the non-essential use of mercury (e.g. in labs) and safely manage and recycle mercury-containing wastes.

R-11. By December 31, 1999, draft rules for the permitting of recycling facilities in order to ensure mercury recycling is conducted in an environmentally sound manner.

R-12. Draft legislation to prohibit the non-essential use of mercury in consumer and commercial products for introduction in the 2000 New Hampshire Legislative Session.

R-13. By June 30, 1999, conduct outreach in conjunction with the BIA and DHHS to educate businesses about the health hazards of mercury, encourage compliance

with hazardous waste regulations and increase recycling and safe management of mercury-containing wastes.

4.4 Hospital/Medical/Infectious Waste Incinerators

New Hampshire's thirteen operating hospital/medical/infectious waste incinerators (HMIWIs) are also a source of mercury emissions, although recent HMIWI closings such as the WMI Medical Service of New England in Hudson and Dartmouth Hitchcock Medical Center eliminated almost 50% of HMIWIs emissions in New Hampshire. In medical and laboratory settings, mercury is often found in thermometers, vacuum gauges, manometers, switches, thermostats and button batteries. Mercury is also used in laboratories as a reagent and catalyst for such tests as Chemical Oxygen Demand (COD), and in staining, fixative, and preservative applications. As illustrated in Section 4.2, the *EPA Mercury Study Report to Congress* (*December 1997*) showed incineration of medical wastes to be responsible for 20% of mercury released into the air. New Hampshire estimates the mercury contribution to be approximately 9% from these sources.

New federal regulations for HMIWIs were finalized on August 15, 1997. These regulations require these sources to meet an emission limit of 0.55 mg/dscm. Soon after the EPA rule was issued, the Natural Resources Defense Council (NRDC) and the Sierra Club sued EPA, charging that the emissions standards were too lenient and did not provide adequate incentives for medical waste generators to adopt pollution prevention and waste reduction methods. This issue is currently under litigation, and oral arguments are scheduled to be heard in November, 1998. Although these EPA limits do not adequately limit mercury emissions, they are stringent enough to impact most HMIWI facilities. The *NEG/ECP Regional Mercury Action Plan* calls for the states and provinces to require HMIWIs to reduce mercury emissions to 0.055 mg/dscm, ten times more stringent than the EPA standard, but still double proposed limits on municipal waste combustors. DES is currently in the rulemaking process to establish a HMIWI regulation which will require applicable sources to meet the NEG/ECP recommended 0.055 mg/dscm mercury emission limit. This rule is expected to be adopted by November 1998. Once all sources are in compliance with the requirements of this rule (June 2000), DES estimates that mercury emissions from HMIWIs will be reduced by approximately 90%. This reduction will be accomplished through a combination of source reduction initiatives, source closures and the installation of pollution control equipment. Specific cost estimates to control mercury at HMIWIs are not readily available, but are likely to be comparable to those for small municipal waste combustors.

As with small municipal waste combustors, switching to non-mercury products, along with removal of mercury from the medical waste stream prior to incineration will likely be more cost-effective than installing emission controls. Fortunately, the use of mercury in medical and laboratory equipment and procedures is diminishing with the advent of non-mercury technologies

(such as digital thermometers) and changes in laboratory practices, including conversion to micro-scale procedures. Switching to non-mercury methods and products will be further encouraged through a Memorandum of Understanding (MOU) recently executed between the US Environmental Protection Agency and the American Hospital Association (AHA). Among other goals, the MOU calls for the "virtual elimination of mercury waste from the health care industry waste stream by the year 2005." This is a goal that New Hampshire also embraces and will work diligently to accomplish, in conjunction with other appropriate agencies and organizations. This area holds much promise for significant reductions in New Hampshire as several hospital facilities in the state have expressed interest in going "mercury free" and discussions with the New Hampshire Hospital Association indicate that they are supportive of this approach. DES is prepared to work cooperatively with the NHHA, DHHS, and other organizations and health care facilities to accomplish the goal of virtual elimination of mercury.

4.4.1 Recommended Actions Regarding Hospital/Medical/Infectious Waste Incinerators

R-14. Reduce mercury emissions from HMIWIs by:

(a) Requiring facilities to meet a mercury emission limit of 0.055 mg/dscm by January 1, 2002; and

(b) Establishing an external stakeholder workgroup (HMIWI Workgroup) by October 31, 1998 to, among other tasks, evaluate the technical and economic feasibility of reducing the HMIWI mercury emission limit to 0.028 mg/dscm or lower. This workgroup should consist of representatives from DES, DHHS, New Hampshire Hospital Association, industry, environmental groups and other interested parties.

R-15. Develop emissions testing requirements for HMIWIs by:

(a) Conducting initial DES emissions stack tests on representative sources by December 31, 1998; and

(b) Developing appropriate emissions testing requirements based on the findings of the initial DES emissions tests by June 30, 1999.

R-16. Establish a workgroup on Pollution Prevention in the Healthcare Industry (Healthcare Workgroup) by October 31, 1998 in order to facilitate the goal of virtual elimination of mercury-containing waste from the medical waste stream. The workgroup should consist of representatives from DES, DHHS, New Hampshire Hospital Association, industry, environmental groups and other interested parties. The workgroup will conduct outreach to health care providers and laboratories to encourage the use of alternative products and procedures, such as digital thermometers, manometers, and microscale chemistry methods, by January 1, 1999.

R-17. Require all generators of mercury-containing medical waste to introduce mercury source reduction and source separation programs by January 1, 2000.

R-18. Draft legislation, by November 1, 1999 (with an effective date of July 1, 2003), to prohibit the disposal of all mercury-containing products and equipment in medical waste incinerators (see R-5(c)). This legislation will serve as a backstop to ensure pollution prevention objectives are achieved.

4.5 Utility and Non-Utility Boilers

Coal-fired power plants and boilers (utility, industrial, commercial and residential) contribute 50% (24% from power plants, 26% from the other sources) of the mercury emitted in New Hampshire. Mercury is a natural constituent of coal and other fossil fuels, and it is liberated when these fuels are burned for the generation of power or heat. These sources are not currently regulated as mercury emitters.

EPA has recently requested data that would require owners of coal-fired utility boilers larger than 25 megawatts to measure, on a weekly basis, the mercury content of the coal they burn. The facilities will report the results to EPA, along with the corresponding volume of coal burned in each unit. EPA will use this data to determine whether or not mercury emissions from coal-fired utility boilers should be regulated at the federal level. In addition, the State of Connecticut has recently passed legislation that will also affect utility boilers burning coal as well as other fuels. Under this statute, the Connecticut Department of Environmental Protection is required to establish uniform performance standards for electric generating facilities supplying power to end users in the State. The standards are to be designed to improve air quality and will be based on the type of fuel being used. The standard will limit the emission rates of several pollutants including mercury.

Source reduction techniques which would reduce the mercury contribution from coal-fired power plants do exist, including: coal washing, conversion of plants to another fuel source (e.g., natural gas), energy conservation and alternative energy sources. However, these methods have not been widely used in the United States. Exploring the feasibility of implementing these methods should be part of any mercury reduction effort.

Conversion of power plants from coal to natural gas (or construction of new natural gas-fired generating plants), along with the implementation of energy conservation measures, would significantly reduce mercury emissions in New Hampshire and provide simultaneous large reductions in emissions of other pollutants such as nitrogen oxides, particulate matter and sulfur compounds, and greenhouse gases. This option holds considerable promise because a new natural gas pipeline is being constructed in the State.

Additional controls on utility boilers could also significantly reduce mercury emissions. For a coal-fired plant similar to Public Service Company of New Hampshire's (PSNH) Merrimack Station, requiring the use of existing technology such as activated carbon injection could achieve a 75% or better mercury control efficiency. These more stringent control measures would cost an estimated $19 million (capital) and $6.4 million in total annual costs (*US EPA, June 1996*). Over a 40 year life, the cost of such mercury control equipment translates to approximately a 1% increase in electric costs for the average consumer (*NHDES,1998*). If technically and economically feasible, controls on coal-fired power plants in New Hampshire would eliminate about 246 pounds of mercury emissions per year (16% of New Hampshire's annual emissions) and would have the added benefit of reducing other emissions including particulates (mercury control requires enhanced particulate control).

Large utility boilers, as well as smaller non-utility industrial/commercial boilers, burn a significant amount of #6 and #2 fuel oil which contains small amounts of mercury. Most recent estimates (1997) show that over 238 million gallons of #6 and #2 fuel oil are burned in these types of boilers each year in New Hampshire. The burning of this fuel represents 16% of the total mercury emissions in the State. These estimates also indicate that over 241 million gallons of #2 fuel oil are burned each year for residential use, representing 15% of the total mercury emissions in the State. Presently, no pollution control technologies exist that can cost effectively reduce mercury emissions from the burning of fuel oil. The only existing ways to reduce emissions from these sources is through energy efficiency (burning less oil) or by burning cleaner fuels (e.g., switching from #6 to #2 fuel oil or natural gas).

In addition to coal and oil-fired utility boilers, New Hampshire also has six wood-fired power plants. Because of the low mercury content in wood, the combined mercury emissions from all six facilities is approximately eight pounds per year.

4.5.1 Recommended Actions Regarding Utility and Non-Utility Boilers

R-19. Encourage greater implementation of energy efficiency and conservation programs for residential, commercial, and industrial customers by:

(a) Participating actively in New Hampshire Public Utility Commission (NHPUC) proceedings relating to energy efficiency (ongoing);

(b) Encouraging the initiation of and active participation in proceedings at the NHPUC (and in regional efforts) relating to disclosure of the environmental characteristics of power sales (ongoing);

(c) Assisting New Hampshire's Interagency Energy Efficiency Committee in energy saving efforts such as expeditiously adopting Energy Star Building Programs for State buildings (1998-2003); and

(d) Assisting the Governor's Office of Energy and Community Services in outreach to electricity consumers about reducing mercury emissions through greater energy efficiency (ongoing).

R-20. Reduce mercury emissions from utility and non-utility boilers by:

(a) Encouraging expeditious development of lower-mercury generation sources such as natural gas, solar photo-voltaics and fuel cells through permitting processes and in the allocation of emission allowances (ongoing).

(b) Establishing an external stakeholder workgroup (Electric Workgroup) by October 31, 1998, which should consist of representatives from DES, DHHS, utility industry, environmental groups and other interested parties, to assess the technical and economic feasibility of:

1. **Requiring a 75% reduction in mercury emissions from coal-fired power plants by the year 2005;**

2. **Repowering coal-fired power plants in New Hampshire to natural gas (study to be completed by September 30, 1999); and**

3. **Switching from #6 fuel oil to #2 fuel oil or natural gas (study to be completed by September 30, 1999).**

4.6 Wastewater and Sludge

4.6.1 Introduction

It is generally agreed that non-combustion sources, such as municipal wastewater discharges, industrial, commercial and residential wastewater discharges, and sludge contribute from a trace amount to 4% of the environmental mercury loading. Typical New Hampshire wastewater treatment facility test results for mercury are presented below.

Figure 6

AVERAGE MERCURY LEVELS IN NEW HAMPSHIRE EFFLUENT AND SLUDGE

Source	Influent (mg/l)	Effluent (mg/l)	Sludge (mg/kg)
Concord	**<0.002**	**<0.002**	**2.01**
Claremont	**(not avail.)**	**0.0008**	**0.46**
Dover	**<0.0002**	**<0.0002**	**0.90**
Manchester	**<0.0002**	**<0.0002**	**1.60**
Merrimack	**<0.0007**	**<0.001**	**0.49**
Milford	**<0.0005**	**<0.0005**	**0.94**
Nashua	**<0.004**	**<0.004**	**<0.22**
Somersworth	**<0.0002**	**<0.0002**	**1.00**
Franklin	**0.001**	**<0.001**	**4.05**

Source: NHDES Industrial Pretreatment Program, 1996 Annual Pretreatment Reports

Note: Results showing "<" refer to a quantity less than detection limits.

4.6.2 Wastewater

Past research has indicated that the small amount of mercury found in sewage becomes bound up in sludge rather than discharged in treatment plant effluent to New Hampshire waterways. The recent development of new water quality testing procedures may shed new light on this potential source of mercury. On May 15, 1998 EPA proposed a new mercury detection method (method 1631) for water which allows detection of mercury at a minimum level of 0.05 parts per trillion (ppt). Current detection methods cannot detect mercury levels below 200 ppt, thus the new method will allow the detection of mercury in wastewater effluent at much lower levels than previously possible.

Adoption of this new method, which is currently undergoing a public comment period, will likely result in lower mercury standards under the National Pollutant Discharge Elimination System (NPDES) permitting program for wastewater dischargers. Under EPA's Great Lakes Initiative, the health based standard for mercury is 1.8 ppt. With the new detection method, this standard may be more widely applied outside of the Great Lakes area. This may affect a diverse group of industries that have not had a problem complying with discharge limits. In New Hampshire, there are currently no industrial facilities or wastewater treatment plants with mercury effluent discharge limits. How many of these industries will be subject to mercury limits in the future remains to be seen. Method 1631 may also drive new efforts to curb the deposition of airborne mercury, particularly from coal-burning utilities.

Pollution prevention techniques will be extremely important in reducing both effluent and emission levels of mercury. Due to the potential ramifications of this new detection method, DES should carefully monitor the developments surrounding the this method, and encourage the expeditious adoption of the method by EPA. In addition, DES should begin collecting sampling data as soon as possible, on background levels of mercury in New Hampshire's lakes and rivers, in order to have a means by which to compare effluent levels of mercury with background levels.

4.6.3 Sludge

A recent comprehensive evaluation of mercury levels in New Hampshire sludge revealed that 99% of all sludge that is currently applied to land as fertilizer had values less than 4.8 mg/kg, with a maximum value of 7.7 mg/kg. The average value for land-applied sludge was 1.5 mg/kg. These values are well below the current EPA "exceptional quality" limit of 17 mg/kg for land applied sludge. Using the average concentration of mercury in sludge of 1.5 mg/kg, multiplied by the roughly 18,600 tons of sludge land-applied in New Hampshire annually, the total mercury discharged equals about 24,500 grams, or 54 pounds. Approximately two-thirds of the land-applied sludge is generated in New Hampshire, while one-third comes from out-of-state sources. Out-of-state sludge has been found to have mercury levels comparable to sludge generated in New Hampshire. Most research indicates that mercury in sludge is tightly bound and tends to remain tightly bound to the soil. The rate of conversion to methyl mercury, the most dangerous form of mercury to humans and living organisms, is greatly enhanced by anaerobic biological activity, which does not normally occur in land application situations. A recent study published in the *Journal of Environmental Quality* (*Carpi, et. al., 1997*) suggests that mercury in land-applied sludge may be a more significant source of emissions than previously thought. In their study, the researchers stated that the data was too limited to be conclusive and recommended further investigation. DES will continue to evaluate new information on mercury in sludge as it becomes available and provide for regulatory adjustments as needed.

The Division of Public Health Services, Bureau of Health Risk Assessment (BHRA) has been addressing the questions of risk of communicable disease from exposure to sewage sludge and the risk of adverse health effects from exposure to chemicals in sludge. In March 1996, DES adopted rules to augment EPA's CFR 503 regulations to ensure that land application of sludge does not endanger human health or environment. Based on exposure limits that would not result in adverse health effects, these regulations allow mercury concentrations in sludge of up to 57 mg/kg and set an "exceptional quality" limit of 17 mg/kg.

To further ensure the protection of public health and the environment, DES is currently in the process of adopting new Sludge Management Rules (Env-Ws 800) which will set a mercury concentration limit of only 10 mg/kg. This is equal to the most stringent standard currently in place in New England (Vermont and Massachusetts also have this standard). These rules will further reduce the limit to 7 mg/kg effective January of 2001, making this mercury limit the most stringent in New England (provided the other states do not lower their limits). These New Hampshire standards are five and eight times more stringent respectively than the concentrations allowed by federal standards, and 1.5 and 2.4 times more stringent than the federal Part 503 - Table 3, Pollutant Concentration Limits. It is worth noting that the mercury levels currently found in New Hampshire sludge are generally less than or equal to amounts found in commercially manufactured fertilizers.

New Hampshire has one sludge incineration facility currently operating. The facility is located in Manchester and is estimated to contribute less than 1% of the total mercury emissions in the state. Although this is a relatively small contribution to the overall emissions inventory, sludge incinerators and recommendations to reduce their mercury contribution are specifically addressed in the *Regional Mercury Action Plan*. Consistent with regional efforts, actions should be taken in New Hampshire to evaluate the actual contribution of mercury from this source and methods to reduce that contribution.

4.6.4 Recommended Actions Regarding Wastewater and Sludge

R-21. Adopt stringent rules for mercury in wastewater sludge, setting a limit of 10 mg/kg upon adoption in 1998 and reducing that limit to a more stringent, technology-based limit by 2001.

R-22. Evaluate the technical and economic feasibility of adopting stringent rules for mercury in wastewater discharges, setting a health-based limit of 1.8 parts per trillion. Study to be completed by June 30, 2000.

R-23. Conduct outreach, through the DES Industrial Pretreatment and Pollution Prevention Programs, to eliminate or minimize the non-essential use of mercury in industrial, commercial, government, educational and residential facilities, by September 30, 1999.

R-24. Develop a water quality sampling program to determine background levels of mercury in surface waters of the state and existing effluent levels at industrial

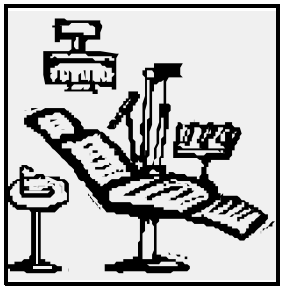
facilities and wastewater treatment plants (upon adoption of EPA Method 1631).

R-25. Require an emission stack test at the Manchester Sludge Incinerator by June 30, 1999, in order to establish its current mercury emission rate and to develop future periodic emissions testing requirements.

R-26. By June 30, 1999, evaluate the feasibility of adopting a 0.01 mg/dscm or lower mercury emission limit for the Manchester sludge incinerator.

4.7 Dental Amalgam

Amalgam, a dental filling material which contains mercury, is a 1:1 mixture of mercury and an alloy consisting of silver, tin, copper and zinc. Only 45% of the mercury used by dentists is incorporated into the new amalgam filling in the mouth. Smaller amalgam particles collected in the vacuum equipment trap are disposed of in the trash, or they pass through the trap and are released to the sewer system or subsurface sewage disposal system. Dental wastes are a source of mercury in wastewater discharges as well as in air emissions if captured amalgam is disposed in municipal solid waste and later incinerated. Alternatives to mercury-containing dental amalgam are available and should be evaluated for use by New Hampshire dentists.



CASE STUDY
Mercury-Free Amalgam

Like a number of other dentists, five years ago, Dr. David Bloom, a Salem, NH dentist, began to switch from mercury-containing amalgam to new, plastic resins for filling his patients' cavities. Plastic resins have been under development for about ten years, and recently a practical formulation been found that adheres to both the enamel and dentin of the tooth. As a result, Dr. Bloom has now completely eliminated the use of mercury amalgam in his practice.

Plastic resins take twice as long as mercury amalgam to apply, so there is an added cost to their use. However, by using plastic resins, the generation of mercury wastes is avoided, and Dr. Bloom has eliminated the costs of managing and disposing of amalgam as a hazardous waste. Furthermore, Dr. Bloom's patients prefer plastic resins because the plastic can be tinted to match the color of the tooth, making the filling invisible. More importantly, plastic resins adhere through a chemical bond to the surface of the tooth, so their application requires far less tooth to be removed than a traditional amalgam filling, which requires the cavity to be greatly enlarged inside the tooth.

Dr. Bloom and many of his patients are also well aware of the environmental benefits of eliminating the use of mercury-containing amalgam. Asked if he could think of any reason why a dentist might prefer to use mercury-containing amalgam, Dr. Bloom replied, "It's like asking anyone today if they'd prefer to listen to scratchy old 45s rather than CDS."

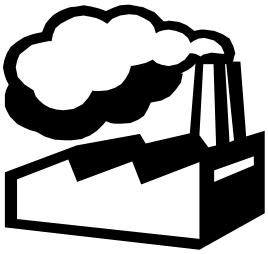
4.7.1 Recommended Actions Regarding Dental Amalgam

R-27. By June 30, 1999, conduct outreach to the general public and dentists' offices in conjunction with the New Hampshire Dental Society to encourage the voluntary use of alternatives to mercury-containing amalgam; and encourage the proper collection and disposal of waste amalgam.

R-28. Draft legislation, by November 1, 1999 (with an effective date of July 1, 2003) to prohibit the use of mercury-containing amalgam. This legislation will be used as a backstop to ensure that pollution prevention objectives are achieved.

4.8 Industrial Processes

Nationally, 92% of industrial mercury releases to the environment are from primary lead production, secondary mercury production, chlor-alkali production (production of chlorine and sodium hydroxide), and Portland cement production. None of these industries have operations in New Hampshire. Industries operating in New Hampshire that use mercury in their processes include manufacturers of electrical equipment, instruments, batteries and fluorescent lamps. These potential sources of mercury pollution are not believed to be significant, because they are already required by federal and state regulations to properly manage and dispose of wastes containing toxic constituents such as mercury as regulated hazardous wastes.



5.0 DISCUSSION AND FINDINGS

Mercury pollution is a significant problem in New Hampshire and throughout the Northeast. Citizens, industry, environmental regulators, environmentalists, and political leaders have expressed much concern about mercury pollution due to its potential human health and environmental consequences. Because mercury is an issue of such great concern, DES has already completed or initiated a number of projects and regulatory actions to address sources and impacts of mercury (see **Appendix 1**). Widespread interest in this problem at both the state and regional levels should spur increased efforts to achieve reductions in mercury contamination. DES believes that the most effective reduction methods are those which encompass both voluntary and mandatory efforts to prevent and control mercury emissions.

Additional controls on air emissions from large combustion sources could be particularly effective in reducing mercury from those sources. Source control strategies are generally straightforward to monitor and enforce, especially if focused on a particular source category. For example, reducing the mercury emission limit to 0.028 mg/dscm for New Hampshire's largest municipal waste combustors would involve only two facilities and provide a 33% reduction in the State's mercury emissions. Existing technology can achieve such reductions, and the testing and enforcement of such limits is considered to be technically and economically feasible. Similarly, additional controls on coal-fired power plants, if technically feasible, could result in a reduction of 246 pounds (16% of total emissions) of mercury per year in New Hampshire. For both coal-fired power plants, and large waste combustion sources there are a number of prevention options which should be evaluated, along with the use of additional controls.

Requiring "end of the pipe" emission limitations for small municipal solid waste incinerators would effectively reduce mercury from these sources, but the economic burden of such mandates may make removal of mercury sources from the solid waste stream a more desirable strategy. Also, Article 28-a of the New Hampshire Constitution prohibits state agencies from imposing unfunded mandates on municipalities, so its provisions must be carefully examined before municipalities are subjected to additional requirements. Article 28-a issues, if any, could be overcome by creating an adequate funding mechanism, such as a surcharge on mercury-containing products, to provide municipalities with funds to meet mercury emission limits on small MSW Combustors or to fund collection and recycling programs for mercury-containing products like fluorescent lamps. This strategy has worked successfully with RSA 149-M:18, Town Reclamation Trust Fund, which allows towns to add a surcharge to motor vehicle registration fees and direct those funds to recycling programs for automotive wastes. The Rural Community Toxic Waste Project has considered recommending an advance disposal fee on products with hazardous components to the New Hampshire Legislature. Such a fee was turned down by the Legislature in 1992 and has not been pursued legislatively since.

New Hampshire has adopted a waste management hierarchy under RSA 149-M which calls for source reduction and reuse (collectively referred to as pollution prevention) as preferred waste management options. These are followed by composting, recycling, incineration and landfilling. Pollution prevention strategies that eliminate the source of the problem (e.g., pursuing the elimination of mercury in consumer products) are much more beneficial than traditional "end of pipe" solutions. While short-term control measures to minimize mercury pollution can be used to achieve more

immediate reductions, particularly from individual sources, implementing source reduction as a long-term solution is the optimum strategy. For example, Toxics in Packaging laws (see sidebar on page 12) have been a resounding success because they target specific hazardous substances in packaging, such as lead, mercury, chromium and cadmium at the source. Unlike such laws, however, outright mercury bans could affect products like fluorescent lamps that have other environmental benefits (e.g., energy efficiency) over their alternatives. Consideration of the balance of such environmental effects is essential when designing effective mercury reduction strategies. A further benefit of pollution prevention is that it often illuminates and reinforces individual environmental responsibility.

Public involvement is an important component for effectively solving the mercury contamination problem. To guide the implementation of this ***New Hampshire Mercury Reduction Strategy*** and further examine options for mercury pollution prevention and reduction, DES will establish a multi-stakeholder task force.

5.0.1 Recommended Action Regarding Mercury Task Force

R-29. By October 31, 1998, establish a multi-stakeholder *New Hampshire Mercury Task Force*. The Task Force should consist of representatives from the New Hampshire Legislature, DES, DHHS, BIA, affected industries and municipalities, the New Hampshire Fish and Game Department (F&G), academia, environmental groups and other interested parties. This Task Force will meet at least annually to review progress on the implementation of the Mercury Reduction Strategy and update it as necessary.

5.1 Public Outreach and Education

Because mercury wastes and emissions are generated by all segments of the population, outreach, education and technical assistance should be an integral part of any mercury source reduction strategy. Specific education initiatives are contained in this strategy, for each source category. In addition, greater efforts should be made to publicize the health hazards of mercury and the existing statewide fish consumption advisory. New Hampshire is committed to conducting a comprehensive public outreach campaign for mercury, and will also actively participate in educational efforts developed by the Regional Mercury Task Force.

5.1.1 Recommended Actions Regarding Public Outreach and Education

R-30. Beginning in January, 1999, conduct outreach and education activities, in conjunction with other interested agencies and organizations, on mercury hazards, alternatives to mercury containing products and methods to reduce the release of mercury to the environment.

R-31. Conduct education and outreach activities, in conjunction with the DPHS and the F&G, to increase public awareness of the statewide freshwater fish consumption advisory. In particular, conduct outreach to those segments of the population that are most sensitive (e.g., pregnant women, young children)

to the health effects of mercury and that consume greater quantities of freshwater fish (e.g. subsistence fishers), by September 30, 1999.

R-32. Conduct outreach, including the distribution of existing facts sheets, to users of mercury (e.g. schools, laboratories, government agencies) on the proper handling and clean-up of mercury spills, beginning in January, 1999.

R-33. Conduct training, through the solid waste operator training program, on the identification and removal of mercury-containing wastes prior to incineration and ensure that those products are safely recycled (ongoing).

R-34. Actively participate in regional public education and outreach efforts on mercury hazards and alternatives to the use of mercury-containing products (ongoing).

5.2 Research and Monitoring

New Hampshire has recently installed a mercury deposition monitor in Laconia as part of a regional monitoring network. Additionally, DHHS in cooperation with DES has been monitoring mercury levels in freshwater fish and has developed an extensive database. This data will be used to evaluate trends in fish mercury levels and update consumption advisories. New Hampshire will continue to work cooperatively with the other New England States and Eastern Canadian Provinces to address additional research and monitoring needs identified by the ongoing NEG/ECP Regional Mercury Task Force. In addition, as a member of this task force, New Hampshire will continue to investigate new and existing sources of mercury (e.g., mobile sources and non-utility boilers) and pursue reductions in emissions from those sources.

5.2.1 Recommended Actions Regarding Research and Monitoring

R-35. Continue support for in-state mercury sampling and monitoring programs in order to evaluate trends in mercury deposition and impacts. This information will be used to update the strategy as necessary (ongoing).

R-36. Actively participate in the NEG/ECP Regional Mercury Task Force efforts to support and expand research and analysis to improve the understanding of mercury sources, impacts and cycling in the environment (ongoing).

5.3 Related Federal Initiatives

5.3.1 Introduction

In addition to the recommended state actions detailed in this strategy, DES should continue to monitor, comment on and encourage federal efforts to manage and eliminate mercury contamination. Examples of some of these efforts include: calling for the appropriate and safe management of the US Department of Defense mercury stockpile; advocating for the

expeditious adoption of the new mercury detection method for wastewater; commenting on EPA rules governing emissions sources; advocating for the collection and analysis of mercury emissions data from coal-fired power plants; monitoring progress on the waste reduction Memorandum of Agreement between EPA and the American Hospital Association; and keeping track of US Coast Guard efforts to monitor the M/V Empire Knight, a sunken ship off the Maine coast containing a considerable amount of mercury; and urging the development of a national mercury reduction strategy and federal legislation to eliminate the non-essential use of mercury in products. The major federal mercury initiatives are described below.

5.3.2 M/V Empire Knight

In February, 1944 the M/V Empire Knight, a 428 foot British freighter ran aground on Boon Island Ledge, Maine and later broke into two sections. The stern section which included the ship's cargo holds sank in approximately 260 feet of water, one and one half miles from Boon Island Ledge. In August, 1990, the Coast Guard became aware of the existence of a "proposed" plan of stowage dating from 1944 which indicated that 221 flasks containing elemental mercury may have been present on the vessel. Later investigation by divers confirmed that all 221 manifested flasks were located in cargo hold 5. All the flasks were recovered but due to their deteriorated condition they were nearly empty. Approximately 1,230 pounds of mercury and nearly 2,200 pounds of mercury-contaminated debris were recovered. An estimated 16,000 pounds of mercury remains unaccounted for and is believed to be spread throughout cargo hold 5. The Coast Guard judged it to be of greater risk to attempt removal since further dispersal of the mercury was very likely. Sampling analysis showed that concentrations of mercury were elevated inside the cargo hold but quickly dropped off to negligible levels in the sediment outside.

The Coast Guard convened a Regional Response Team who unanimously recommended in August, 1995 that the Coast Guard establish an environmental exclusion zone around the wreck. The zone would be 1,000 yards on a side, inside of which no dredging, diving, salvage, anchoring, fishing or other activity that could interfere with the wreck be conducted. The zone would not limit marine navigation as vessels would still be allowed to transit the area. The zone became effective in 1996. The National Oceanic Atmospheric Administration's Hazardous Materials Response and Assessment Division concluded in 1994 that ecological and human health risks from further release of mercury are not of an imminent nature. At present the Regional Response Team is working on the long term monitoring plan for the exclusion zone site.

5.3.3 Department of Defense Mercury Stockpile

The United States Department of Defense (DoD) currently maintains a mercury stockpile of approximately 11 million pounds, which is excess to DoD's needs. In response to concerns from EPA and several members of Congress, the DoD voluntarily suspended mercury sales in June of 1994. Numerous state and regional environmental organizations and agencies, (including DES) have since expressed to DoD their support for the continued suspension of mercury sales from the stockpile. DoD is currently conducting an environmental analysis, which includes the possible environmental consequences of the various options for disposition of the mercury. The Department of Defense is consulting with

EPA on the environmental analysis, which, when completed, will be available for public comment and review.

5.3.4 Federal Regulatory and Policy Initiatives

There are several EPA regulatory and policy initiatives currently underway which bear monitoring by the states. Those initiatives include: the development and adoption of a new mercury detection method for wastewater discharges; the collection of emissions data from coal-fired utilities; and the promulgation of air emissions standards for several source categories. In addition to EPA's efforts, several bills have been introduced at the congressional level which deal with everything from reducing mercury in products to increase regulation of mercury emissions sources.

5.3.5 Recommended Actions Regarding Related Federal Initiatives

R-37. Continue efforts to monitor, comment on and influence federal legislation, regulatory and policy initiatives with respect to mercury research, use, management, treatment and disposal (ongoing).

R-38. Continue active participation in establishing long term monitoring protocols for the M/V Empire Knight exclusion site and to improve understanding of the patterns of contamination around the ship; and, whether or not mercury is becoming more available to the biota (ongoing).

R-39. Encourage the Coast Guard to consider the implications of mass movement of bottom sediments in the region of the M/V Empire Knight exclusion zone possibly induced by microseisims or larger scale seismic events whereby the sediment mass including the mercury could be transported over a considerable distance thereby exacerbating the problem, by December 31, 1998.

R-40. Encourage the Coast Guard to keep the states advised with respect to technical advances which could render recovery of the remaining mercury on the M/V Empire Knight technically and economically feasible, by December 31, 1998.

6.0 CONCLUSION

Mercury contamination is a serious public health concern. The seriousness of this problem is reflected in the commitment of the Governors of the New England States and the Premiers of Eastern Canadian Provinces to adopt an aggressive *Regional Mercury Action Plan*. The *Regional Mercury Action Plan* calls for the establishment of a Regional Mercury Task Force and contains a number of major recommendations for reducing mercury. This task force will be looking, on a regional basis, at many of the same issues that this strategy encompasses. Working aggressively and cooperatively on a regional basis will substantially reduce mercury emissions from in-region sources.

Through implementation of this strategy and participation in the Regional Mercury Task Force, New Hampshire intends to aggressively pursue reductions in its own mercury emissions while at the same time pursuing similar emission reduction efforts for upwind sources. Just as New Hampshire took steps to reduce its own acid rain and nitrogen oxide emissions in advance of federal requirements, and demonstrated leadership in adopting progressive requirements for toxics in packaging and in batteries, paint and fluorescent lamp recycling, the State must again demonstrate leadership to encourage the federal and other state governments to reduce their mercury emissions. Because mercury can remain in the atmosphere for very long periods, emission contributions from distant upwind emission sources are important to address. By taking initiative in reducing its own mercury emissions, New Hampshire can insist on similar reductions of mercury from upwind regions in order to achieve progress in solving the public health and ecological threat of mercury contamination in our environment.

In many instances, source reduction (rather than expensive control technology) may prove to be the more cost-effective way to reduce man-made mercury contamination. Pollution prevention options eliminate mercury at the source rather than simply controlling it, providing a more permanent solution to mercury contamination. The actions contained in this strategy are expected to result in at least a 50% reduction in New Hampshire's mercury emissions over the next five years. Beyond that, New Hampshire will continue to strive for the virtual elimination of all harmful anthropogenic mercury releases to our environment.

APPENDICES

APPENDIX 1

PAST AND PRESENT NEW HAMPSHIRE MERCURY REDUCTION EFFORTS

To minimize potential health risks posed by mercury, the New Hampshire Department of Environmental Services has already taken actions and adopted legislation, rules and policies to reduce mercury releases to the environment. These include:

- **RSA 149-M:28 Restrictions on Battery Sales and Disposal** restricts the sale of certain mercury-containing batteries, prohibits the disposal of mercuric oxide batteries and sets certain requirements on products containing mercury-containing batteries;

- **RSA 149-M:32-40 Toxics Reduction in Consumer Packaging** prohibits the sale of any package which intentionally contains lead, cadmium, **mercury** or hexavalent chromium;

- **Env-Ws 316 NH Water Quality Rules** establish a 2 ug/l mercury limit for drinking water supplies;

- **Env-Ws 410 NH Groundwater Protection Rules** establish a 2 ug/l mercury limit for groundwater supplies;

- **Env-Ws 430 NH Surface Water Rules** establish a 0.14 ug/l mercury limit for surface waters;

- **Env-Wm 403 NH Hazardous Waste Rules** establish 0.2 mg/l mercury leachability limit in waste for a hazardous waste determination;

- **Env-A 1400, NH Air Toxics Rules** establish a 24 hour and an annual Ambient Air Limit for mercury emissions of 0.300 ug/m^3. These limits became effective for new and modified sources on May 8, 1998. Existing sources will have up to 3 years from the effective date to achieve compliance with the new standards. Fossil fuel burning plants and devises are exempted from this rule.

- **Fluorescent Lamp Recycling Policy (interim)** exempts mercury-containing lamps from NH Hazardous Waste Rules requirements if lamps are unbroken and destined for recycling; and

- **Minimum Standards for Mercury-Containing Lamp Recycling Operations** would currently be incorporated into a facility's permit conditions. The Department is working on drafting rules which would place these standards in the hazardous waste regulations.

- **NH Lamp Management Contract** provides for the collection and management of mercury-containing lamps and ballasts from all state agencies. The contract requires recycling to the greatest extent possible. Municipalities and institutions are also eligible to use the contract.

Additional initiatives currently in progress which are relevant to mercury pollution prevention and control include:

- **NH Universal Waste Rule (UWR)**, expected to be adopted by DES in 1999, will likely include mercury-containing devices such as thermostats and switches as well as mercury-containing lamps. The UWR promotes the environmentally sound recycling of these wastes by streamlining and reducing their regulatory requirements for collection, consolidation and transportation.

- **Env-Ws 800 NH Septage and Sludge Disposal Rules,** currently in the process of being adopted will establish a mercury limit of 10 mg/kg for land application uses, once adopted, and lower the limit to a more stringent, technology-based limit, effective January, 2001.

- **Env-A 3300 Municipal Waste Combustor Rules** require large facilities (capable of burning greater than 250 tons per day of municipal solid waste) to comply with the federal emissions guideline of limiting mercury emissions to 80 micrograms per dry standard cubic meter or to demonstrate a removal efficiency of 85%.

- **Governor's Building Energy Conservation Initiative:** the Department of Environmental Services, Governor's Office of Energy and Community Services and Department of Administrative Services are cooperatively working on a project to make state buildings more energy efficient, thereby reducing energy demands and mercury emissions.

- **Regional Assessment of Atmospheric Deposition of Mercury** - The Department of Environmental Services, in cooperation with the U.S. Environmental Protection Agency, has recently installed, and is maintaining, a mercury deposition monitoring station as part of the New England Mercury Deposition Network. The station is located at our existing ozone monitoring site at the Laconia Airport was operational as of September 1997. Deposition monitoring is a critical link in assessing and modeling the relationships between the source, transport, deposition, and fate of mercury emissions.

- **Hospital/Medical/Infectious Waste Incinerator (HMIWI) Rule**, scheduled for adoption in November 1998, will establish a mercury emission limit of 0.055 mg/dscm. All sources must achieve compliance by June 2000.

APPENDIX 2

MAJOR MERCURY EMISSIONS SOURCES IN NEW HAMPSHIRE*

Town	Facility	Tons Burned Per Year	Hg Emissions (estimated lbs/year)	Percent Total Emissions
Large Municipal Waste Combustors				
Claremont	Wheelabrator Claremont Co., L.P.[1]	70,384.0	154.9	
Concord	Wheelabrator Concord Co., L.P.[1]	182,560.0	401.6	
	TOTALS	***252,944.0***	***556.5***	***35%***
Small Solid Waste Incinerators[2]				
Auburn	Town of Auburn Incinerator	1,024.0	5.7	
Bridgewater	Hebron-Bridgewater SWD	985.0	5.5	
Candia	Town of Candia Incinerator	1,200.0	6.7	
Lincoln	Lincoln/Woodstock SWD	2,684.0	15.0	
Litchfield	Town of Litchfield Incinerator	720.0	4.0	
Nottingham	Town of Nottingham Incinerator	321.0	1.8	
Ossipee	Town of Ossipee Incinerator	1,946.0	10.9	
Pelham	Town of Pelham Incinerators	1,664.0	9.3	
Sutton	Town of Sutton Incinerator	602.0	3.4	
Wilton	Town of Wilton Incinerator	578.0	3.2	
	TOTALS	***11,724.0***	***65.5***	***4%***
Medical Waste Incinerators [3]				
Berlin	Androscoggin Valley Hospital	15.7	1.2	
Concord	Concord Hospital	475.0	35.2	
Derry	HCA Parkland Medical Center	100.0	7.4	
Exeter	Exeter Hospital	70.2	5.2	
Hanover	Dartmouth Medical School	7.8	0.6	
Keene	The Cheshire Medical Center	62.7	4.6	
Laconia	Lakes Region General Hospital	13.5	1.0	
Lancaster	Weeks Memorial Hospital	16.3	1.2	
Littleton	Littleton Regional Hospital	27.8	2.1	
Manchester	Catholic Medical Center	195.0	14.4	
	Elliot Hospital	534.3	39.5	
	Veterans Affairs Medical Center	26.0	1.9	
Portsmouth	HCA Portsmouth Regional Hospital	321.6	23.8	
	TOTALS	***1,865.9***	***138.1***	***9%***
Sewage Sludge Incinerators[4]				
Manchester		4,476.0	14.3	
	TOTALS	***4,476.0***	***14.3***	***1%***
Coal Fired Power Plants[5]				
Bow	Merrimack Station	1,235,159.0	259.4	
Portsmouth	Schiller Station**	325,626.0	68.4	
	TOTALS	***1,560,785.0***	***327.8***	***21%***
Fuel Oil				
#2 Fuel Oil[6]	Residential Use	241,128,750 (gallons)	231.5	
#2 Fuel Oil[6]	Commercial/Industrial Use	80,376,250 (gallons)	77.2	
#6 Fuel Oil[7]	Commercial/Industrial Use	158,046,000 (gallons)	173.9	
	TOTALS	***479,551,000 (gallons)***	***482.6***	***30%***
TOTAL EMISSIONS FROM MAJOR MERCURY SOURCES			***1584.8***	***100%***

* *Based on 1997 Inventory*

** *Based on 1996 Inventory. 1997 inventory of 418,285 tons of coal burned was abnormally high due to nuclear power plant outages.*

APPENDIX 2 (continued)

MAJOR MERCURY EMISSION SOURCES IN NEW HAMPSHIRE - NOTES

1. Calculated using an emission factor of 2.2×10^{-3} lb/ton of waste burned (with controls), taken from EPA AP-42 Emission Factors, October 1996.

2. Calculated using an emission factor of 5.6×10^{-3} lb/ton of waste burned (uncontrolled), taken from EPA's Locating and Estimating Mercury Emissions From Sources of Mercury and Mercury Compounds, September 1993.

3. Calculated using an emission factor of 74×10^{-3} lb/ton of mixed waste burned , taken from EPA's Hospital/Medical/ Infectious Waste Incineration Guidelines, November 1997.

4. Calculated using and emission factor of 3.2×10^{-3} lbs/ton for sewage sludge incineration with a Venturi Scrubber, taken from EPA's Locating and Estimating Mercury Emissions From Sources of Mercury and Mercury Compounds, September 1993. This factor is the high end of the scale and may overstate the emissions from this source.

5. Calculated using an emission factor of 0.21×10^{-3} lbs/ton for the burning of bituminous coal in a facility with an electrostatic precipitator, taken from EPA's Locating and Estimating Mercury Emissions From Sources of Mercury and Mercury Compounds, September 1993 .

6. Calculated using an emission factor of 0.96 lb/10^6 gallons of #2 fuel oil burned, taken from EPA's Locating and Estimating Mercury Emissions From Sources of Mercury and Mercury Compounds, September 1993.

7. Calculated using an emission factor of 1.1 lb/10^6 gallons of #6 fuel oil burned, taken from EPA's Locating and Estimating Mercury Emissions From Sources of Mercury and Mercury Compounds, September 1993.

APPENDIX 3

ANTHROPOGENIC EMISSION SOURCES OF MERCURY

EPA's ***Mercury Study Report to Congress*** (December 1997) estimated national mercury emissions sources and ranked them by their relative contribution. National emissions estimates, along with New Hampshire estimates, are presented below.

Emission Source	EPA Estimated Annual Emissions (Nationwide) 1994-1995	NH Estimated Annual Emissions 1997[1]
Medical Waste Incinerators	10.1%	9% (13 sources)
Municipal Waste Combustors	18.7%	39% (12 sources)
Utility Boilers	32.8	24%
Industrial Manufacturing[2]	10.0%	N/A
Industrial, Commercial, and Residential Boilers (all fuels)[3]	20.2%	26%
Sewage Sludge Incinerators	0.6%	1%
Hazardous Waste Combustors	4.4%	N/A
Other[4]	3.2%	1%
TOTALS	**100%**	**100%**

Notes:

(1) New Hampshire figures are estimates based on the use of modeling, actual emissions may vary depending upon activity levels and type of combustion material. See **Appendix 1** for additional emissions information and information related to estimating emissions.

(2) Estimates of industrial sources in New Hampshire are unavailable at this time, but are expected to be minimal since the major types of mercury emitting industries are not found in NH.

(3) Residential boiler emissions (including wood stoves) are variable depending upon usage and mercury content of the fuel(s).

(4) Other sources of mercury include mercury-containing lamp breakage and medical and dental emissions. Although specific estimates are not available, these sources are believed to comprise a trace to less than 1% of total mercury emissions. There are many uncertainties surrounding the quantification of these sources.

Sources: EPA, Mercury Study Report to Congress, December, 1997.
NHDES Air Emissions Inventory Data, 1997.

APPENDIX 4

PRELIMINARY IMPACT ESTIMATE OF ADOPTING NEG/ECP RECOMMENDED MERCURY EMISSION LIMIT FOR MUNICIPAL WASTE COMBUSTORS

PROPOSED ACTION

DES proposes to adopt a 0.028 mg/dscm (milligrams per dry standard cubic meter) mercury emission limit for the two largest Municipal Waste Combustors in New Hampshire (the Concord and Claremont Wheelabrator facilities). This would require the installation of additional air pollution control technology.

EXPECTED MERCURY REDUCTIONS

If New Hampshire applied the 0.028 mg/dscm limit to both the Concord and Claremont Wheelabrator facilities, Statewide mercury emissions would be reduced by approximately 33%.

FISCAL IMPACTS

A carbon injection system would need to be installed at each facility to meet the 0.028 mg/dscm limit. EPA estimates the cost of these controls to be in the $500,000 $1,000,000 range. DES estimates that the total cost will be close to $1,000,000 per facility.

To better estimate potential cost impacts on affiliated municipalities, in order to ensure that its assessment is appropriately conservative, DES conducted a preliminary analysis assuming a cost of $1,000,000 for controls at each of the two facilities. DES further assumed that these costs would be apportioned to the towns according to the amount of waste that they send to the facility. DES evaluated costs according to one, five, ten and fifteen year pay-backs on a town-by-town basis. Spreadsheets which provide detailed costs for each alternative are available through the DES.

FINANCIAL ASSISTANCE OPTION

Currently DES provides 20% to 30% grants and State Revolving Fund low interest loans to towns and cities for water, sewer and landfill closure projects. State financial assistance is not currently available to cities and towns for emission controls. If the State chose to provide financial assistance to New Hampshire towns and cities to cover 100% of their portion of the cost of the proposed mercury emission controls, it could either appropriate funds for a one-time payment or establish a grant program to reimburse the towns for their costs over the life of a bond.

If the State elected to make a one-time payment, it would need to appropriate up to $700,000 for controls at the Concord facility and up to $490,000 for the Claremont facility, for a total one-time appropriation up to $1,200,000. Alternatively, the State could bond the cost of purchasing the control equipment.

APPENDIX 5

ESTIMATED COSTS FOR ESTABLISHING A MUNICIPAL LAMP RECYCLING PROGRAM

Below are the estimated costs for setting up a municipal lamp collection and recycling program. As proposed, the program would be similar to the DES program for collecting used oil, and could significantly enhance the recycling rate of household fluorescent lamps. The cost to a community (with an existing transfer station) to set up a program should be under $100, and storage will cost little, provided the municipality uses an existing building to store the bulbs. Recycling costs vary depending on the number of lamps actually recycled by the community.

(1) Fiber Lamp Drum	$ 15.95
(1) 5 Gallon Pail with Lid	$ 15.95
Cleaning Equipment	$ 20.00
Personnel Protective Clothing	$ 25.00
Total	**$ 76.90**

Recycling costs (for full drum) = $ 30.60 (1 drum holds 85 four foot lamps)
Minimum pick-up fee = $ 100.00

Notes:

(1) This estimate is based on a municipality participating in the State lamp recycling contract with Global Recycling Technologies, Inc., (GRT) of Stoughton, MA, 1-800-478-6055. All NH municipalities are eligible to participate in the contract. The current contract period is June 16, 1997 through June 30, 2000. Pickup days and times and or container purchase can be arranged directly between GRT and the municipality. All users must provide a central pick up area, GRT will provide all shipping labels and shipping documents at the time of pick up.

(2) It is uncertain how long it would take a town to collect 85 lamps, so recycling costs could vary greatly. In addition, under the current state contract with Global Recycling there is a $100 minimum charge per pick-up, which could be cost prohibitive for some communities.

(3) Capital costs would increase substantially if the town were to construct a building to protect lamps from the elements. Some commercial collectors use tractor-trailers as collection, storage and transportation facilities. There would also be an additional cost if staff had to be hired to oversee collection and handling of lamps.

(4) Cost estimates are based on discussions between DES Waste Management staff and lamp recycling facility personnel and suppliers.

Source: NHDES, Waste Management Division, 1997

APPENDIX 6

LIST OF REFERENCES

1. *Mercury Study Report to Congress,* U.S. Environmental Protection Agency, December, 1997.

2. *Draft Executive Summary of the Mercury Study Report to Congress*, U.S. Environmental Protection Agency, June, 1996.

3. *Northeast States and Eastern Canadian Provinces Mercury Study, A Framework for Action,* NESCAUM, NEWMOA, NEIWPCC and Canadian Ecological Monitoring Network, February, 1998.

4. *Regional Mercury Action Plan,* Conference of New England Governors and Eastern Canadian Premiers, June 1998.

5. A*ir Emissions Inventory Data,* New Hampshire Department of Environmental Services, 1993, 1994 and 1995.

6. *Economic Impact Analysis for Proposed Emissions Standards and Guidelines for Municipal Waste Combustors,* U.S. Environmental Protection Agency, March 1994.

7. *Management of Used Fluorescent Lamps: Preliminary Risk Assessment,* Research Triangle Institute, October 1992 (revised May 14, 1993).

8. *Environmental Risk Analysis: Spent Mercury-Containing Lamps*, National Electrical Manufacturers Association (NEMA), March 1996.

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10. *Mercury Emissions From the Disposal of Fluorescent Lamps,* U.S. Environmental Protection Agency, Office of Solid Waste, June, 1997.

11. *Annual Pretreatment Reports,* New Hampshire Department of Environmental Services, Industrial Pretreatment Program, 1996.

12. *Dental Waste Management Fact Sheet*, North Carolina Office of Waste Reduction, March, 1996.

13. *Database on Mercury in Fish,* NH Department of Environmental Services.

14. *Mercury Data on the Common Loon*, NH Loon Preservation Committee, a self-funded project of the Audubon Society of New Hampshire, 1997.

15. *Breath Taking, Premature Mortality Due to Particulate Air Pollution in 239 American Cities,* Natural Resources Defense Council, 1996

16. *Memorandum of Understanding Between the Environmental Protection Agency and the American Hospital Association,* June, 1998.

17. *Methyl Mercury Contamination and Emissions to the Atmosphere from Soil Amended with Municipal Sewage Sludge*, Anthony Carpi, Steven E. Linberg, Eric M. Prestbo, and Nicolas S. Bloom, *Journal of Environmental Quality*, 1997.

18. *Geographic Trend in Mercury Measured in Common Loon Feathers and Blood*, Evers et. al., *Environmental Toxicology and Chemistry, Volume 17*, 1998.

19. *Summary of Loon Preservation Committee Research and Management Activities for the 1997 field season*, unpublished, 1998.

APPENDIX 7

LIST OF ACRONYMS

AAL	Ambient air limit
AHA	American Hospital Association
ASNH	Audubon Society of New Hampshire
BHRA	Bureau of Health Risk Assessment
BIA	Business and Industry Association of New Hampshire
COD	Chemical Oxygen Demand
CFR	Code of Federal Register
DES	Department of Environmental Services
DHHS	Department of Health and Human Services
EPA	US Environmental Protection Agency
F&G	NH Fish & Game Department
IWMS	Integrated waste management strategy
MOU	Memorandum of Understanding
MG/DSCM	Milligrams per dry standard cubic meter
MG/KG	Milligrams per kilogram
MSW	Municipal solid waste
MWC	Municipal waste combustors
HMIWI	Hospital/Medical/Infectious Waste Incinerators
NPDES	National Pollutant Discharge Elimination System
NEG/ECP	New England Governors and Eastern Canadian Premiers
NEIWPCC	New England Interstate Water Pollution Control Commission
NESCAUM	Northeast States for Coordinated Air Use Management
NEWMOA	Northeast Waste Management Officials Association
NHHA	New Hampshire Hospital Association
NHPUC	New Hampshire Public Utility Commission
NRDC	Natural Resources Defense Council
PPM	Parts Per Million
PPT	Parts Per Trillion
PSNH	Public Service Company of New Hampshire
TCLP	Toxicity Characteristic Leaching Procedure
USFDA	United States Food and Drug Administration
UW Rule	Universal Waste Rule (a.k.a. UWR)

APPENDIX 8

NEW HAMPSHIRE MERCURY REDUCTION STRATEGY
SUMMARY MATRIX OF RECOMMENDATIONS

RECOMMENDED ACTIONS	DATE
MUNICIPAL WASTE COMBUSTORS (39% of NH mercury emissions)	
R-1. Reduce mercury emissions from Municipal Waste Combustors (MWCs) by:	
(a) Drafting legislation to require a mercury emission limit of 0.028 mg/dscm or lower for the State's two largest MWCs by January 1, 2002; and	**1/1/02**
(b) Evaluating, by September 30, 1999, the overall technical and economic feasibility of closing small MWCs over time or requiring small MWC's to meet a limit of 0.028 mg/dscm or lower.	**9/30/99**
R-2. Investigate and draft legislation, if appropriate, by November 1, 1999, to provide financial assistance to New Hampshire municipalities in implementing mercury reduction controls and programs.	**11/1/99**
R-3. Require annual emissions monitoring and stack testing in order to more accurately monitor actual mercury emissions from the State's two largest MWCs beginning in 1998.	**12/31/98**
R-4. Establish an external stakeholder workgroup (MWC Workgroup) by October 31, 1998 to, among other tasks, evaluate the need for periodic emissions testing at smaller MWCs. The workgroup should consist of representatives from DES, New Hampshire Department of Health and Human Services (DHHS), Business and Industry Association of New Hampshire (BIA), industry, municipalities, environmental groups and other interested parties.	**10/31/98**
R-5. Encourage reductions in the amount of mercury-containing products entering the municipal waste stream through an Integrated Waste Management Strategy developed by the MWC Workgroup by:	
(a) Continuing to work with the MWC operators, through the solid waste operator training program, to identify and remove mercury-containing wastes prior to incineration and ensure that those products are safely recycled (ongoing);	**ongoing**
(b) Working with construction/demolition, recycling and other contractors and the MWC Workgroup to remove mercury-containing products such as thermostats and fluorescent tubes from construction and demolition debris and promote their safe recycling, by June 30, 1999; and	**6/30/99**
(c) Drafting legislation by November 1, 1999 (with an effective date of July 1, 2003) to prohibit the disposal of mercury-containing products and equipment in municipal waste combustors and medical waste incinerators. This legislation will serve as a backstop to ensure pollution prevention objectives are achieved.	**11/1/99**

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RECOMMENDED ACTIONS	DATE
HOUSEHOLD/MUNICIPAL SOLID WASTE	
R-6. Continue efforts with municipalities and others to remove mercury-containing batteries from the waste stream and ensure safe recycling consistent with the Integrated Waste Management Strategy detailed in R-5 (ongoing).	**ongoing**
R-7. By December 31, 2000, consistent with the Integrated Waste Management Strategy, encourage lamp manufacturers and vendors to reduce the mercury which enters the environment from their products by: **(a) Providing recognition for products with lower mercury content;** **(b) Helping them establish "take back" programs to ensure safe recycling; and** **(c) Providing information to consumers, through product labeling and other means, regarding mercury hazards and safe recycling of mercury-containing lamps.**	**12/31/00**
R-8. Consistent with the Integrated Waste Management Strategy, encourage municipalities to implement lamp collection and recycling programs (similar to current municipal used oil collection programs or household hazardous waste collection days) by December 31, 2000 by: **(a) Providing technical assistance to municipalities in establishing such programs; and** **(b) Providing financial assistance (e.g., through loans, grants or from product surcharges) to municipalities to assist in establishing such programs.**	**12/31/00**
R-9. Beginning June 30, 1999, initiate a public outreach campaign, including mercury-oriented public service announcements to encourage greater citizen awareness of mercury hazards, alternatives to mercury-containing products and the need to safely recycle mercury-containing wastes.	**6/30/99**
R-10. Beginning June 30, 1999, conduct specific outreach to schools, institutions and government agencies on methods to eliminate the non-essential use of mercury (e.g. in labs) and safely manage and recycle mercury-containing wastes.	**6/30/99**
R-11. By December 31, 1999, draft rules for the permitting of recycling facilities in order to ensure mercury recycling is conducted in an environmentally sound manner.	**12/31/99**
R-12. Draft legislation to prohibit the non-essential use of mercury in consumer and commercial products for introduction in the 2000 New Hampshire Legislative Session.	**1/1/00**
R-13. By June 30, 1999, conduct outreach in conjunction with the BIA and DHHS to educate businesses about the health hazards of mercury, encourage compliance with hazardous waste regulations and increase recycling and safe management of mercury-containing wastes.	**6/30/99**

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SUMMARY MATRIX OF RECOMMENDATIONS

RECOMMENDED ACTIONS	DATE
HOSPITAL/MEDICAL/INFECTIOUS WASTE INCINERATORS (9% of NH mercury emissions)	
R-14. Reduce mercury emissions from HMIWIs by:	
(a) Requiring facilities to meet a mercury emission limit of 0.055 mg/dscm by January 1, 2002; and	**1/1/02**
(b) Establishing an external stakeholder HMIWI Workgroup by October 31, 1998 to, among other tasks, evaluate the technical and economic feasibility of reducing the HMIWI mercury emission limit to 0.028 mg/dscm or lower. This workgroup should consist of representatives from DES, DHHS, New Hampshire Hospital Association, industry, environmental groups and other interested parties.	**10/31/98**
R-15. Develop emissions testing requirements for HMIWIs by:	
(a) Conducting initial DES emissions stack tests on representative sources by December 31, 1998; and	**12/31/98**
(b) Developing appropriate emissions testing requirements based on the findings of the initial DES emissions tests by June 30, 1999.	**6/30/99**
R-16. Establish a workgroup on Pollution Prevention in the Healthcare Industry (Healthcare Workgroup) by October 31, 1998 in order to facilitate the goal of virtual elimination of mercury-containing waste from the medical waste stream. The workgroup should consist of representatives from DES, DHHS, New Hampshire Hospital Association, industry, environmental groups and other interested parties.	**10/31/98**
The workgroup will conduct outreach to health care providers and laboratories to encourage the use of alternative products and procedures, such as digital thermometers, manometers, and micro scale chemistry methods, by January 1, 1999.	**1/1/99**
R-17. Require all generators of mercury-containing medical waste to introduce mercury source reduction and source separation programs by January 1, 2000.	**1/1/00**
R-18. Draft legislation, by November 1, 1999 (with an effective date of July 1, 2003), to prohibit the disposal of all mercury-containing products and equipment in medical waste incinerators (see R-5(c)). This legislation will serve as a backstop to ensure pollution prevention objectives are achieved.	**1/1/99**

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RECOMMENDED ACTIONS	DATE
UTILITY AND NON-UTILITY BOILERS (50% of NH mercury emissions)	
R-19. Encourage greater implementation of energy efficiency and conservation programs for residential, commercial, and industrial customers by:	
(a) Participating actively in New Hampshire Public Utility Commission (NHPUC) proceedings relating to energy efficiency (ongoing);	**ongoing**
(b) Encouraging the initiation of and active participation in proceedings at the NHPUC (and in regional efforts) relating to disclosure of the environmental characteristics of power sales (ongoing);	
(c) Assisting New Hampshire's Interagency Energy Efficiency Committee in energy saving efforts such as expeditiously adopting Energy Star Building Programs for State buildings (1998-2003); and	**ongoing**
(d) Assisting the Governor's Office of Energy and Community Services in outreach to electricity consumers about reducing mercury emissions through greater energy efficiency (ongoing).	**ongoing**
R-20. Reduce mercury emissions from utility and non-utility boilers by:	
(a) Encouraging expeditious development of lower-mercury generation sources such as natural gas, solar photo-voltaics and fuel cells rough permitting processes and in the allocation of emission allowances (ongoing).	**ongoing**
(b) Establishing an external stakeholders workgroup (Electric Workgroup) by October 31, 1998, which should consist of representatives from DES, DHHS, utility industry, environmental groups and other interested parties, to assess the technical and economic feasibility of:	**10/31/98**
1. Requiring a 75% reduction in mercury emissions from coal-fired power plants by the year 2005;	**12/31/05**
2. Repowering coal-fired power plants in New Hampshire to natural gas (study to be completed by September 30, 1999); and	**9/30/99**
3. Switching from #6 fuel oil to #2 fuel oil or natural gas (study to be completed by September 30, 1999).	**9/30/99**
WASTEWATER AND SLUDGE	
R-21 Adopt stringent rules for mercury in wastewater sludge, setting a limit of 10 mg/kg upon adoption in 1998 and reducing that limit to a more stringent, technology-based limit by 2001.	**12/31/01**
R-22 Evaluate the technical and economic feasibility of adopting stringent rules for mercury in wastewater discharges, setting a health-based limit of 1.8 parts per trillion. Study to be completed by June 30, 2000.	**6/30/00**
R-23 Conduct outreach, through the DES Industrial Pretreatment and Pollution Prevention Programs, to eliminate or minimize the non-essential use of mercury in industrial, commercial, governmental, educational and residential facilities, by September 30, 1999.	**9/30/99**
R-24 Develop a water quality sampling program to determine background levels of mercury in surface waters of the state and existing effluent levels at industrial facilities and wastewater treatment plants (upon adoption of EPA Method 1631).	
R-25 Require an emissions stack test at the Manchester sludge incinerator by June 30, 1999, in order to establish its current mercury emission rate and to develop future period emissions testing requirements.	**6/30/99**
R-26 By June 30, 1999, evaluate the feasibility of adopting a 0.01 mg/dscm or lower mercury emission limit for the Manchester sludge incinerator.	**6/30/99**

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RECOMMENDED ACTIONS	DATE
DENTAL AMALGAM	
R-27 By June 30, 1999, conduct outreach to the general public and dentists' offices in conjunction with the New Hampshire Dental Society to encourage the voluntary use of alternatives to mercury-containing amalgam; and encourage the proper collection and disposal of waste amalgam.	**6/30/99**
R-28 Draft legislation, by November 1, 1999 (with an effective date of July 1, 2003) to prohibit the use of mercury-containing amalgam. This legislation will be used as a backstop to ensure that pollution prevention objectives are achieved.	**11/1/99**
MERCURY TASK FORCE	
R-29 By October 31, 1998, establish a multi-stakeholder *New Hampshire Mercury Task Force*. The Task Force should consist of representatives from the New Hampshire Legislature, DES, DHHS, BIA, affected industries and municipalities, the New Hampshire Fish and Game Department (F&G), academia, environmental groups and other interested parties. This Task Force will meet at least annually to review progress on the implementation of the Mercury Reduction Strategy and update it as necessary.	**10/31/98**

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RECOMMENDED ACTIONS	DATE
PUBLIC OUTREACH AND EDUCATION	
R-30 Beginning in January, 1999, conduct outreach and education activities, in conjunction with other interested agencies and organizations, on mercury hazards, alternatives to mercury containing products and methods to reduce the release of mercury to the environment.	**1/1/99**
R-31 Conduct education and outreach activities, in conjunction with the DHHS and the F&G, to increase public awareness of the statewide freshwater fish consumption advisory. In particular, conduct outreach to those segments of the population that are most sensitive (e.g., pregnant women, young children) to the health effects of mercury and that consume greater quantities of freshwater fish (e.g. subsistence fishers), by September 30, 1999.	**9/30/99**
R-32 Conduct outreach, including the distribution of existing facts sheets, to users of mercury (e.g. schools, laboratories, government agencies) on the proper handling and clean-up of mercury spills, beginning in January, 1999.	**1/1/99**
R-33 Conduct training, through the solid waste operator training program, on the identification and removal of mercury-containing wastes prior to incineration and ensure that those products are safely recycled (ongoing).	**ongoing**
R-34 Actively participate in regional public education and outreach efforts on mercury hazards and alternatives to the use of mercury-containing products (ongoing).	**ongoing**
RESEARCH AND MONITORING	
R-35 Continue support for in-state mercury sampling and monitoring programs in order to evaluate trends in mercury deposition and impacts. This information will be used to update the strategy as necessary (ongoing).	**ongoing**
R-36 Actively participate in the NEG/ECP Regional Mercury Task Force efforts to support and expand research and analysis to improve the understanding of mercury sources, impacts and cycling in the environment (ongoing).	**ongoing**

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RECOMMENDED ACTIONS	DATE
RELATED FEDERAL INITIATIVES	
R-37 Continue efforts to monitor, comment on and influence federal legislation, regulatory and policy initiatives with respect to mercury research, use, management, treatment and disposal (ongoing).	**ongoing**
R-38 Continue active participation in establishing long term monitoring protocols for the M/V Empire Knight exclusion site and to improve understanding of the patterns of contamination around the ship; and, whether or not mercury is becoming more available to the biota (ongoing).	**ongoing**
R-39 Encourage the Coast Guard to consider the implications of mass movement of bottom sediments in the region of the exclusion zone possibly induced by microseisims or larger scale seismic events whereby the sediment mass including the mercury could be transported over a considerable distance thereby exacerbating the problem, by December 31, 1998.	**12/31/98**
R-40 Encourage the Coast Guard to keep the states advised with respect to technical advances which could render recovery of the remaining mercury technically and economically feasible, by December 31, 1998.	**12/31/98**